

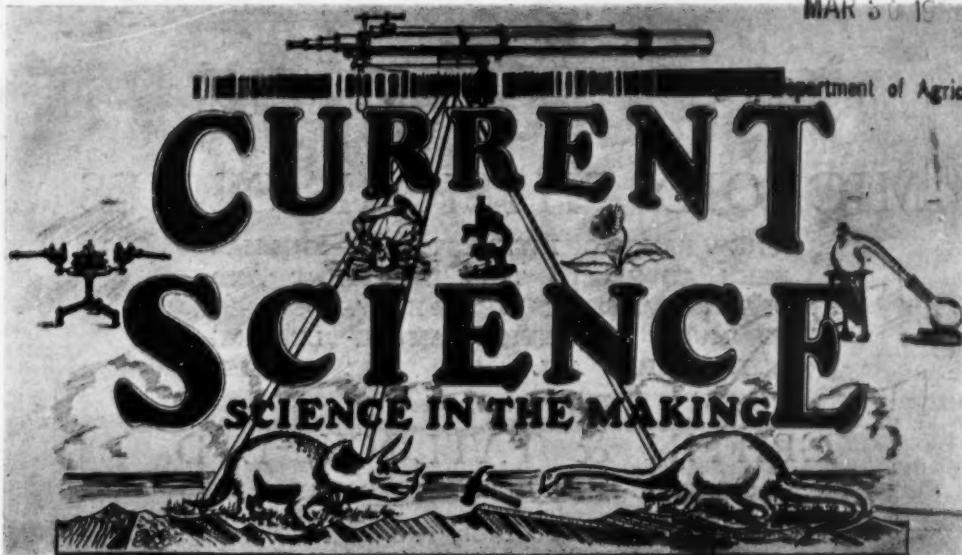
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Vol. II]

FEBRUARY 1934

[No. 8]

A MONTHLY JOURNAL DEVOTED TO SCIENCE.

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The Statham Committee Report.*

THE results of the enquiry into the present education system in Travancore are published in a skilfully compiled document, many of the observations and recommendations of which have a purely local interest. However, the chapter on Secondary Education is full of substance and flavour and, holding as this subject does the key-position in the framework of educational organisation, offers certain fundamental problems of far-reaching importance, which are well worth re-examination. Admittedly there is a certain amount of legitimate dissatisfaction and a large measure of criticism about the results achieved by this department and it is only natural that neither the University authorities nor the discerning public are happy over the annual output of imperfectly prepared material from the secondary schools. Several causes have tended to produce this unsatisfactory position and it seems to us that few of them could well have been avoided. Secondary Education in India is at the present moment passing through a critical transitional phase in its development and it will probably take a long time before it can fully regain its function of contributing to the moral and material progress of the country.

The complaint against the lowering of standards in the existing high schools is a grievous charge against the teaching, the examination and the equipment. Promotions from the lower classes are alleged to be very unsatisfactory and the prescription of lower minima for the eligibility of matriculates and S.S.L.C. candidates for admission to the University courses as well as the overcrowding of classes by the pupils who have repeatedly failed at the public examinations are usually regarded as other causes which have led to a fall in standards. Another equally serious cause according to the critics of secondary education is the language difficulty, candidates having to acquire proficiency in a foreign tongue which is the medium of instruction and examination. While we admit that there is a large element of truth in all these criticisms, we do not believe that they alone are responsible for the definitely poor standard of attainment presented by the secondary school candidates.

*Report of the Travancore Education Committee, June 1933.

We consider that the efficiency of teaching depends more on the capacity and scholarship of the teacher, the range and variety of the subjects included in the curricula, the methods and appliances employed in conveying instruction and the intelligent and industrious co-operation of the pupils, than on the rigidity of examinations and higher minima. It is true that the latter influences the former, but the curse of education in India is its dominance by examinations. Secondary Education in this country about a generation ago was comparatively free from blemishes such as are attributed to it at present and the criticisms now directed against "standards" were not heard of in those days. The causes which have led to this degeneracy which undoubtedly exists, must be sought for elsewhere.

The doctrine of democratisation of education which according to its exponents means "free education for all," is at the root of the whole trouble. They would "open wide the sluices" and permit "the water of human life to flow under the bridge of education" without considering its purity and power to fertilise. The democratic ideal of education really implies that every child must, "in proportion to his aptitude and regardless of his parents' occupation", be provided with facilities for the attainment of the fullest measure of his intellectual and moral stature, but in practice the ideal actually imposes selection of candidates so that "the unfit may not block the way of the gifted and prevent us from offering to the latter a culture worthy of them." The school is certainly a democratic institution where "children of all origins mix and elbow each other on the same benches," but, while no one need be alarmed at mixing and elbowing, it must be admitted that at least for some time to come the selective effects which are expected of education cannot be realised. The children who come from homes where they have neither the proper spirit nor culture, do not possess that predisposition for learning which the more favoured ones bring to bear on their tasks and a class which presents intellectual gradients of a nature disturbing to the uniform progress of instruction cannot hope to reach such high standards of attainment as did schools a generation ago from which these impediments were comparatively absent. It may be expected to take at least three generations of secondary education before a generation of children can arise, possessing

sufficiently wide and uniform intellectual equipment to profit by instruction in a manner satisfactory to the public and the university authorities. The majority of young men attending our high schools do not now possess the advantages of a cultured home, and they therefore suffer from the handicap of a meagre intellectual heritage. The so-called backward communities have to acquire enlightenment before they can impart it to their children and no amount of impatience and criticism can accelerate this rather slow psychological process. The general awakening of the masses to the benefits of education not as a reward in itself, but as a means of absorption into the professions and public service, has introduced into the class-room intellectual inequalities of a kind unknown to the generation of teachers now disappearing, and their successors are accused of not possessing that touch of alchemy which converts pewter into gold. It is true that the class-room should not recognise social distinctions but its obvious function is to discover and emphasise intellectual differences, for "democracy more than any other form of society needs an élite". The criticism against the lowering of standards really arises from the habit of applying the old yard-stick of efficiency to new and entirely different conditions, there has not yet been sufficient time for the large body of the intellectually backward pupils to acquire from their parents the necessary predisposition for an academic discipline. The setback in standards is a psychological phenomenon, inevitable under the existing circumstances.

Apart from the inherent intellectual weakness of the majority of secondary school pupils, over-crowding of class rooms must militate against the attainment of even reasonable standards. The universities therefore have adopted a more stringent method of selection and some of them are even contemplating a unification of the examination system. Nevertheless, one should not forget that the reasons for this indiscriminate participation in a strictly academic type of education by the people lie very deep. The interests of the public are largely economic and it will not in the end be possible to keep young men in great numbers from utilising any educational opportunities that exist to equip themselves for an honourable living. Are all these young men competent to take learning of an academic type as their ideal in life? The difficulty of

"selection" attains its acuteness when we realise that every detail of secondary education is commonly discussed by the public from all standpoints except the right one, *viz.*, the interests of culture. Really the problem of over-crowding stands in the foreground of all educational reform and its solution,—"to leave the door of higher education no more than ajar,"—however desirable it may be, will not be acceptable to the people. It will take some time for them to be convinced that it would be far wiser for their children to be diverted into vocational schools even at the threshold of secondary education from which they can never hope to derive real profit. The prolonged course of three years' study in the high schools ought to provide abundant opportunities for measuring the candidates' capacities and chances of progress in literary learning and now more than ever a comprehensive scheme of psychological tests for discovering their capabilities and natural aptitudes should be applied in order to diminish the hotch-potch in our schools. Education is a slow process of impregnating the mind, based on careful selection of intelligence wherever it may be found, and nothing can be more hostile to its purposes than the so-called democratic theory that fine literary capacities are found "in widest commonality spread".

The outstanding feature of secondary education in India is the rapid growth in the number of institutions and of the scholars receiving instruction in them. This increase which about a generation ago might have meant advancement of national well-being is now generally regarded as a symptom of people's helplessness. Seventy-five per cent. of the pupils who sit for the public examination at the end of three years of training are found ineligible for admission to the University courses and their literary education unfit them to join their fathers' profession. There is certainly a place and use for all these discarded pupils in the body politic and one of the purposes of secondary education ought to be to discover to these candidates the extent and direction in which they can function as efficient citizens. Education in its widest sense is a continuous process of absorbing the environment which in the secondary stage should be sufficiently diversified and illuminating for the encouragement and utilisation of all kinds of talent in the service of the State. The "wastage of pupils" so often complained of is clearly produced by the inelastic and inhospitable

environment provided by the secondary system of education rather than by the examinations. Secondary education is at present attempting to achieve what would be impossible, even if it were desirable, namely, to cultivate literary interests in every one with a view to higher university courses. The problem of wastage of pupils is bound up with our ignorance of the fundamental structure and capabilities of the adolescent mind and teacher and pupil therefore encounter mutual resistance in the performance of their respective tasks. Revision of curricula constantly tending to the restriction of their range and quality, and prescription of lower minima at the examinations, are not a solution to the problem of "wastage", for they only transfer the problem of "standards" elsewhere.

There is another criticism to which the secondary system of education is exposed especially in those provinces in which the matriculation examination continues to be directed by the University. It seems to us that the latter is unjustifiably accused of exercising a baleful influence on pre-university education. Surely the admitting authorities must be conceded the elementary right of determining the standard of attainment and the range of studies in candidates seeking entrance to the University course and until some years ago, there was no impeachment of the relationship between the universities and the high schools. The increasing admission of misfits into the secondary schools for a purely literary type of education is at the root of this criticism also and the only way of removing the reproach is to provide a wider and more diversified course of instruction for such as seem unlikely to profit by academic studies.

The reform of secondary education in India is attended by difficulties which are absent in other countries. Here a candidate failing in the matriculation examination acquires a social stigma, however capable he may otherwise be and however well-qualified for earning an honourable and independent livelihood. Because the government have placed a premium on university degrees as a qualifying test for admission to administrative posts which are supposed to carry with them social prestige and political power, communities hitherto apathetic to higher education, have discovered, under the stimulus of "Communal representation in the Services", a passion for the rewards which a literary education is expected to

confer. This age-long apathy must necessarily impose a handicap on securing immediate academic distinctions on at least a majority of those who but for communalism, would have been content to carry on and enrich the traditional pursuits of their fathers. We must seek and foster intelligence and scholarship wherever they may be found, but no efforts of education can create them where they do not exist and the money and energy devoted to producing them might more profitably be utilised in training the young men to professions for which they possess specific aptitudes. Perhaps the most serious difficulty confronting any rational reform of education is that within recent years it has come too much within the range of communal suspicions, which can only disappear after government withdraws recognition now accorded to University degrees.

We shall have to wait for administrative reforms to be introduced by the new constitution before we can formulate any schemes for reconstructing the system of secondary education and any proposals for educational reform that may be put forward even when the reconstructed government has been introduced must be of a tentative character, for India is an organism still in the process of becoming. A certain measure of national stability in the wider sphere of its functions is indispensable for the sound evolution of educational reforms the necessity for which will need to be adequately understood by the new legislature. Only a thorough conviction that a sound secondary education with a wide range of selective courses must form the backbone of the national well-being can bring effective means for overhauling the educational machinery slowly, wisely and efficiently.

The Earthquake in North India.

WE associate ourselves with the numerous agencies which have appealed for assistance to relieve the sufferings of our fellow-men in the earthquake-stricken districts of Bihar and Nepal.

The results of the scientific investigations initiated by Dr. L. L. Fermor will, we have no doubt, extend our knowledge of the geological conditions of the Sub-Himalayan regions and perhaps may even provide the people with the means of forecasting these baleful phenomena with some measure of certainty. In these regions which are obviously in the zone of weakness and strain, implied by the severe crumpling of the rock beds in the elevation of the Himalayas, within very recent times, and where the rocks have, therefore, not yet attained stability or quiescence, subcrustal dislocations must be frequent, resulting in more or less disastrous earthquakes always attended by appalling destruction of life and property. The fertility of the Indo-Gangetic alluvial plain has at all times attracted large masses of population who have built in this geologically unstable region, some of the richest cities in the East, little dreaming that their opulence and magnificence practically rest on a powder magazine within a few miles of their foundations.

The recent earthquake is far more intense than the tremors which occurred in 1833 in the same area and is nearly as ruinous as the one which overwhelmed Assam on June

12th, 1897. Earthquakes, floods, famines and cyclones have become numerous and frequent within recent years and the restoration of flourishing and populous cities which are rendered defunct by these catastrophes must be beyond the resources of a single nation. It occurs to us that the League of Nations should devise proposals for setting up an international organisation with the financial support of all countries of the world, to supplement the efforts of private philanthropy in dealing with the cataclysms over which man has no control and against which he has no means of providing protection. We do not believe that our proposal is impracticable for, in our judgment the moral significance of our civilisation must fail if it does not promote an increasing recognition of brotherhood among nations both in times of distress and prosperity, irrespective of their geographical situation and other differences. The League of Nations from its exalted position in the international life is competent to formulate and design schemes for fostering the unity of the different races now divided by narrow parochial interests and no misfortune should occur to any one of them without evoking spontaneous sympathy in the hearts of others. We can conceive of no cause or religion more sacred to humanity than provision of relief for the destitute and suffering and an earthquake is certainly that touch of Nature which ought to make the whole world kin.

The Secondary Structure in Crystals.

By S. Ramachandra Rao,
Annamalai University.

IT has been increasingly recognised in recent years that the simple lattice theory of crystals is not enough to account for the various physical properties of the crystalline state of matter. The existence of a sharp melting point, the accurate lining up of crystalline planes over macroscopic distances, the enormous influence in the physical (particularly magnetic) properties due to the absorption of foreign atoms and the volume effects of crystal grains of macroscopic sizes—these have been advanced by Zwickly as properties which need a revision of the simple lattice theory. To these we may add the regularity of a disperse system of foreign atoms in a crystal as revealed by X-ray spectra, the difficulties of a satisfactory explanation of ferromagnetism on the atomic basis, the existence of anomalous diamagnetism in some crystals as those of bismuth and graphite and the little-understood properties of elasticity (particularly fatigue, after-effect and elastic limit).

The simple lattice theory involves an accurate spacing up of like or unlike atoms in different directions, the interaction between neighbouring atoms being electrostatic or electron linked. It should be mentioned here that while a secondary (as distinguished from the primary or simple lattice) structure seems to be necessary for a proper understanding of several well-known properties, a simple physical picture of such a structure has not yet been conclusively developed.

Zwickly postulates a microcrystal block in a crystal as a region surrounded by a surface physically different from a similar surface taken within the block. This would suggest that the interatomic distance is smaller nearer the surface than inside the block. Zwickly estimates, for example, that the surface of such a block in rocksalt crystal contains 10% more atoms per unit area than in the inter-lattice planes. If such a microscopic structure is identical with the spontaneously magnetised blocks of Heisenberg in his theory of ferromagnetism, it would follow that the surface of these blocks would not merely correspond to the regions of largest crowding of the atoms but also those across which the

electrons are not ferromagnetically coupled with each other.

Zwickly's calculations, based on the small differences observed between the X-ray wavelengths obtained by crystal and grating methods, lead him to a value of nearly 100 A.U. for the linear dimension of the rocksalt block. This would suggest that a block contains nearly 43,000 atoms. Bitter's results based on ferromagnetic data give a value of nearly 10^5 atoms in a microcrystal. These results also indicate that the dimension of the block is of the order of 100 A.U.

It may be pointed out that the secondary structure should give rise to a secondary spectrum in the Bragg reflections; however, since for every 30 planes in the above case we have a secondary surface, the grating obtained is very inefficient. However, Johnson reflected H atoms from a crystal of LiFl and obtained a secondary spectrum which indicated the lattice constant to have a value somewhere between 50 and 100 A.U. It is interesting to mention here the investigations of Jaegar and Zanstra on the crystal structure of rubidium. They found the co-existence of two phases, one phase being present in the other in the form of small blocks containing 36,000 atoms; this leads to a value of nearly 100 A.U. for the secondary lattice constant. It is significant that four different methods have all suggested the same order of value for the dimension of the microcrystal.

We shall now consider some special directions in which the experimental observations fully conform to Zwickly's theory and in fact would not have any other rational explanation except on this basis. First we shall take up the question of the solution of one metal in another. G. L. Clark gives an excellent account of our present knowledge of this subject in his book on *Applied X-rays*. Three cases can be broadly distinguished. In the first case, the atoms of the foreign body B replace or crowd into the lattice atoms of the given metal A. Such a crowding produces a shift in the lines of the X-ray spectra indicating smaller lattice constants. The second case arises when there are both types of microcrystals in the alloy; the characteristic spacings of both the lattices being present in the X-ray

spectra. The third case arises when chemical combinations take place involving predominantly combinations of covalent atoms; these give rise to new spacings of the lattice as revealed by X-ray spectra. It is difficult to understand these distinctions on any satisfactory basis on the simple lattice theory but once we grant the theory of secondary structure, the whole picture becomes intelligible. In the type 2, both sets of microcrystals are co-existent in the alloy in large groups while in the first case the foreign atoms are able to permeate through the microcrystal surfaces into the blocks. The relative quantities of the two constituents settle the nature of the structure of the alloy. At present there is no satisfactory basis for the energy calculations in such cases but there is little doubt that the nature of the permeation of the foreign atoms in the given crystal is fixed by energy considerations. A development along these lines is necessary if the theory of secondary structure is to be placed on a satisfactory quantitative basis.

It is interesting to note that the strongly ferromagnetic iron and the strongly diamagnetic bismuth do not dissolve in each other. This result is significant from the point of view of secondary structure since it seems possible that the consolidating tendencies of the microcrystals of these metals are too strong for the disruption of the individual microcrystals.

Another important observation that needs special notice is that when small quantities of a foreign metal are alloyed with the given metal, the lattice constant does not alter while there is a large alteration in the magnetic susceptibility. On the simple lattice theory it is doubtful whether a reasonable explanation can be given for this observation. On the theory of the secondary structure in crystals, this would mean that the foreign atoms place themselves on the microcrystal borders and while influencing greatly the magnetic properties so largely dependent on the large electron orbits on the microcrystalline surfaces, do not affect the lattice constant predominantly settled by the interior atoms.

That the foreign atoms stay in the microcrystal borders is beautifully verified by the lower melting point in general of the alloys; since the disruptive tendency between the microcrystals amplified by the presence of the foreign atoms, is mainly

responsible for melting. These microcrystals, with their borders very fuzzy and their internal structure rendered less stable, account for the persistence of a crude crystal structure in liquids just after melting. As the liquids are heated this structure is broken rapidly.

The writer has recently investigated the magnetic properties of colloidal powders of strongly diamagnetic and ferromagnetic metals. As a result of these observations and the recent investigations of Goetz, there is abundant evidence to show that when the colloidal powders approach small diameters of the order of 1μ , large changes take place in their magnetic properties. The X-ray spectra of such colloidal powders appear to pass over from those corresponding to crystal powders to those of liquids, at smaller diameters. In certain experiments conducted by the writer some three years ago on the conductivity of compressed colloidal powders of Ceylon graphite the specific conductivity of particles having diameters less than about 1 to 2μ , was larger than of those having larger diameters. The investigations were not pursued at the time since the explanation of such an observation remained obscure. It now appears, however, that such an effect may be genuine and may be accounted for by proportionately greater surface conductivity. Thus the particles having diameters greater than about 1.5μ differ in properties from those having smaller diameters. The writer has shown recently that this may be due to the destruction of a large number of microcrystals on the surface of the macrocrystals.

It is significant that Goetz, to whom we owe a large amount of useful and pioneer work on magnetism and crystal structure, has found that the crystal planes line up regularly over macroscopic distances. A similar secondary structure has been observed by Bitter in magnetised crystals of nickel and iron.

In the theory of ferromagnetism, the secondary structure in crystals plays a predominant part. It is well known that Heisenberg's theory of ferromagnetism postulates the existence of a large number of microcrystals in a crystal. The resultant spins in these microcrystals have random orientations and compensate each other in the absence of an external field. The large amount of work accomplished by various investigators on thin films and the recent work on nickel colloids by Montgomery and

the writer point to the correctness of the assumption of microcrystals in ordinary crystals.

Based on these, Bitter has given a theory of ferromagnetism by which he has accounted for the properties of hysteresis and the Curie points in ferromagnetic bodies.

There is one other direction in which theoretical work should be of great significance in the proper understanding of these problems. Tartakowsky and Kudriawzewska found that the total secondary electron emission from heated nickel decreases suddenly at the temperature corresponding to the Curie point of this metal. Hayakawa has used this method to study transformations from one state to another in metals. The structure electrons of Richardson should be responsible not only for secondary emission but also for conserving the total spin in

a microcrystal so necessary for Heisenberg's theory. If these conclusions are true, it would follow that the regions of the secondary structure around the microcrystals are filled with electron energy levels having a maximum energy of at least 400 volts, and that in this manner the structure electrons are responsible for the Zwicky blocks.

It should be mentioned here that the theory of secondary structure is not without its limitations. Smekal claims that the results obtained with shearing stresses in crystals, particularly in rocksalt, definitely indicate the existence of only an ideal lattice. While therefore the problem of the Zwicky structure in crystals like rocksalt may be an open question, there seems to be, from what we have explained in this article, very little doubt regarding the existence of such a structure in metallic crystals.

Acknowledgment.

WE have pleasure in expressing our deep sense of gratefulness to the Council of the Indian Science Congress for offering "CURRENT SCIENCE" a grant of Rs. 250 for the present year. We need hardly

mention that this infant venture requires all the support which it can receive from all the institutions and individuals devoted to the advancement of scientific research in India.

The Incidence of Silicosis in Kolar Gold Fields, Mysore.

By C. Krishnaswami Rao, B.A., M.B., C.M., M.R.C.P., M.R.C.S.

IT was the impression till recently that there were no cases of silicosis among the miners of Kolar Gold Fields. In the report of "The Miners' Phthisis Conference, South Africa" it is mentioned that no case of silicosis has been reported from K.G.F. While silicosis was so common in other gold mining areas, such as South Africa, that no case had been reported from K.G.F. was really surprising. It was suggested that an investigation may be started to find out the existence or not of silicosis in K.G.F. A committee was formed in 1931 to collect material and to study the peculiar conditions existing in this mining area.

Clinical histories of about one hundred labourers working underground were collected. Seventy-five chest radiograms were taken. As a control, radiograms of twenty people unconnected with underground work were also taken. Three lung specimens removed, Post Mortem of labourers who died of respiratory diseases were made avail-

able for study. Sections were prepared and examined by Pathologists.

After a careful study of this material it was concluded that cases of silicosis do exist in K.G.F. Only, it takes ten to fifteen years of underground work to develop signs of silicosis. It is due to the fact that the quartz reef in K.G.F. contains only 8 to 17% of free silica as compared to the high percentage, namely, 80 to 90 in the South African rock. The collected material was sent to "The Bureau of Medical Research, South Africa," for expert opinion.

Dr. L. G. Irvine and Dr. S. W. Simson were kind enough to give their opinion after studying the material sent to them. Dr. Irvine reports "The Pathological and Radiographic evidence appears to create a *prima facie* case that instances of Silicosis do occur amongst underground workers in the Kolar Gold Mines." He also adds that the material forwarded was inspected by Dr. A. Mavogordato who concurs in the

general conclusions stated in the report. So it can be now affirmed that Silicosis does exist in Kolar Gold Fields, Mysore.

In the *Journal of Hygiene*, August 1933, William R. Jones states that the gold-bearing quartz rock of the Kolar Gold Fields contains more quartz than the South African rock and yet produces dust that has caused no case of silicosis. There is a note on this article in *Nature*, December 16th, 1933, alluding to the point that there is no silicosis in K.G.F.

In view of what has been said, the statement contained in the paper written by W. R. Jones is not quite correct. The incidence of Silicosis may not be so great as in South Africa but there is no doubt that Silicosis does exist among the underground labourers in K.G.F. W. R. Jones is of

opinion that if the rock contains fibrous minerals such as serisite they hasten the process so very considerably that their presence in the exploited rocks and materials is of far greater importance in causing the disease than in the presence of quartz. Again it is stated that such acicular fibres are absent from the Kolar Quartz rock or very rare. Therefore he infers that there is no Silicosis in K.G.F. It is certainly a very interesting observation that has been made by W. R. Jones and it will be taken into consideration in the further investigation that may be carried out in K.G.F.

The object of my writing this article is merely to point out that Silicosis does exist in K.G.F., though not so common as in South Africa.

Letters to the Editor.

Effect of Environment on Awning in Rice.

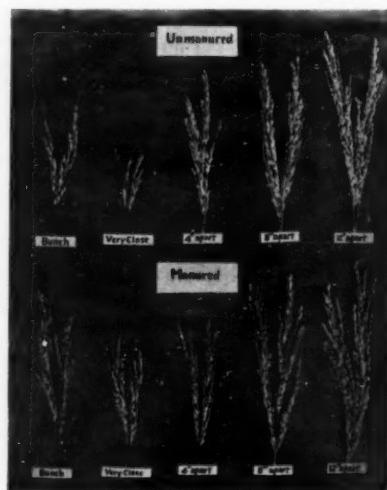
IN 1925, when the writer was in charge of this Research Station, he observed, for the first time, the effect that overcrowding the plants in the field has on awning in rice. It came about this way. In that year, AEB. 108, a pure line type of Gandasala, a variety poor in tillering, was grown as a small bulk crop under two different spacings of $3'' \times 3''$ and $12'' \times 12''$ to see the relative yields when closely and widely planted.

According to conventional spacings given year after year to all the type collections on this Station, AEB. 108 also used to be spaced 6" in the line and 12" between lines. Under such spacing, this type was uniformly noted to be giving awns of the description "short tip" for the last 9 years that it was under study as a type. The awn lengths in these plants invariably were under 10 mm. and the percentage of awned grains never reached 10 per cent. of the total number of grains on an ear, on the average.

On an examination of the crop grown as a bulk, it was found that the plants in the 3" spacing produced ear-heads with longer awns and with more awned grains than those in the 12" spacing. The awn lengths in the 3" spacing reached a maximum of 25 mm. whereas those in the 12" spacing were under 10 mm. in all cases. The number of awned grains was also fewer in the latter case.

Conclusive evidence that over-crowding was responsible for the production of longer

awns and more awned grains in this type was luckily forthcoming at the same time. This was from a bundle of reserve seedlings kept near the label stakes of the planted



Photograph showing the effect of spacing and manuring on Awning in Rice.

crop for filling possible gaps in it, if need be, later on. This bundle containing more than 200 seedlings was squeezed into a hole of about 4 inches square to serve as a reserve. On an examination of the puny ears formed by the emaciated plants in this

bunch, the astonishing fact was revealed that more than 90 per cent. of the grains on the ears were awned and most of the awns were between 40 and 48 mm. in length. A worse case of over-crowding could not have been imagined. An examination of all other awned varieties then growing on the station and bundles of reserve seedlings kept near each, showed that over-crowding had more or less similar effect, on awning, as noted in AEB. 108.

The cause for this phenomenon of increase in awning was at the time supposed by the writer to have been due to a deficiency of plant food and the resulting partial starvation of the over-crowded plants. This belief was strengthened by the fact that very late heads produced during the waning vigour of a plant also produced more, and longer awns.

During the last three seasons since 1931, experiments were entrusted to Mr. V. Krishnaswami, an Assistant of this Station, and he has collected a very large number of ear-heads from the various treatments for measurements of awn lengths and count of awned grains in each.

The object of the experiment, in short, was to test the effect of spacing as well as manuring on "Awning in Rice". The results indicate that the original hypothesis that lack of plant food might be the cause for increase of awns in over-crowding is not tenable, as manuring not only did not suppress awning but actually tended to increase it, though to a far less extent than different spacings did. The accompanying photograph showing typical ears of AEB. 108 taken from different treatments makes it clear to what extent different spacings and manuring affect awning in rice. The term "bunch" in the photograph stands for planting a bundle of over 300 seedlings, as such, in about an area of 4 inches square and the term "very close" for planting a similar number of seedlings in a square foot, the seedlings, in this case, touching almost one another. The other terms are self-explanatory. The manured plot received at the rate of 400 lbs. of ammonium sulphate and 200 lbs. of superphosphate per acre while the unmanured plot had not any of these.

The results of the experiments clearly show to what extent an inherited character of an organism can be modified by its environment. At the same time, the failure of awnless types included in this

experiment, to produce even a remote suggestion of awns despite the maximum over-crowding and the liberal dose of manuring given, goes to prove the other fact that in the absence of a heritable factor or factors for a particular character in an organism environments, howsoever modified, cannot bring such character into being.

As the original hypothesis of partial starvation as the cause of greater awn development in over-crowded plants is no longer tenable, the writer is led to doubt whether a struggle for light among the over-crowded plants is not the cause for this phenomenon.

This hypothesis is being tested now.

M. ANANDAN.

Agricultural Research Station,

Aduturai,

December 9, 1933.

Partial Sterility in the First Generation

Plants of Crosses between Wide

Varieties of the Common Egg Plant

(*Solanum melongina*).

FOR the last two seasons vegetables, such as brinjals, chillies and tomatoes, are being raised on this station. Among the different kinds of brinjals grown, there was a variety got from Mysore which was strikingly different from the rest in various characters including its general look. It had greater resemblance to a datura plant than to ordinary brinjal in its appearance. So using Mysore variety as the common male parent in all, crosses were carried out with four different kinds of ordinary brinjal plants as shown below.—

1. White round ♀ × Mysore brinjal ♂
2. Long mottled ♀ × Mysore brinjal ♂
3. Long purple ♀ × Mysore brinjal ♂
4. Big round ♀ × Mysore brinjal ♂

The first generation plants show considerable vegetative vigour and in general appearance resemble more the Mysore parent and so these are undoubtedly crosses. The chief distinguishing characteristics of the parents and the F₁ would be clear from the photograph (*vide* Plate I).

The most interesting feature of the F₁ generation plants is the partial sterility shown by them. One sowing of the F₁'s with their parents was done on 15-5-1933 and a second one on 29-8-1933, to eliminate any possible seasonal effects. In both the groups of sowing, the number of flowers

produced by the F_1 is 5 to 6 times more than either of the parents and yet fruiting has practically been nil in the F_1 's. The parents which began to flower by the end of July and end of October have exhausted themselves by producing good many fruits, while the F_1 plants have shown no indication of developing any healthy fruit though they flowered as early as 1st August in the first sowing and 2nd November in the second sowing. Only recently one or two very small globe-like fruits of the size of a



Upper Figure: Left—Ordinary Brinjal (Female) Parent, Right— F_1 and *Lower Figure:* Mysore Brinjal (Male).

big gooseberry are seen in the early group of the F_1 's. It is too early to say whether they would develop into normal fruits and contain viable seeds.

On examination of the anthers of the first generation plants, it is found that more than 90 to 95 per cent. of the pollen grains are ill-developed and devoid of contents, while the parental plants grown along with the F_1 's show abundance of healthy pollen in their anthers. This perhaps accounts for the poor setting of fruits by the F_1 plants. Probably this is another example of partial sterility resulting from wide crosses as noted in other species of plants, and the cause for the abortive pollen has to be sought for in the breakdown or degeneration of the chromosomes at the reduction division as noted in other hybrid plants.

Cytological examination of the pollen may prove this to be the fact. Back crossing with the parents is also being attempted to find out if the ovules in the F_1 are fertile.

T. K. BALAJI RAO.

Agricultural Research Station,
Aduturai,
December 12, 1933.

A Note on the Regularities in the Spectrum Ce III.

THE writer has for some time past been studying the regularities in the Spectrum of doubly ionised Cerium. Recently Kalia¹ has given in detail the regularities in the above spectrum. A number of terms originating from the main electronic configurations have been found by him but the J values of many of the terms have not yet been fixed. It is evident, however, from the given J values that, as J changes only by 0 or ± 1 in a transition, the odd terms a, b, c, etc., must all have a J value 3, with the exception of g, r, and s, for which the J values may be 1, 2 or 3 for g, 2 for r and 1 or 2 for s. Each of the terms X, Y, Z, may have $J=2$ or 3. The term denoted by 1S_0 must be one with a J value compatible with the combinations with $J=3$. Besides, assuming the given J values to be correct, the combinations 3F_2 — $4f\ 6s\ ^3F_4$, $5d^2\ ^3P_1$ —p and $5d^2\ ^3P_1$ —t involve a change of 2 in the J values in the transition. $\lambda = 2238 \cdot 69$ classified as the combination A—k, differs too widely ($7 \cdot 1$ cm.⁻¹) from the calculated value to be correct.

It may be noted that if t has a J value 2, $5d^2\ ^3P_1$ —t combination would be allowable but then 3F_4 —t, $5d^2\ ^1G_4$ —t would both have to be rejected. The large number of odd terms with $J=3$ indicate that odd configurations other than $4f\ 5d$ and $5d\ 6p$ must be involved, which in turn should give widely separated terms. It seems that the J values of some of the terms a, b, etc., may not be 3 and that some of the combinations involved may be spurious, as is not unlikely in such a complicated spectrum.

V. D. DABHOLKAR.

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January 15, 1934.

¹ Indian Jour. Phy., 8, 137, Oct. 1933.

- D *Castronodus strassenii*, G. et sp. n.*
A New Nematode Parasite of *Crocidura cœrula*—the Common Musk-shrew or as it is usually called Musk-rat (Vernacular: Chachundar.)

AMONGST the Musk-rats a very heavy infection of this new type of worms prevails in the Hyderabad State. In August 1933, 120 specimens were dissected by me in the Plague Department, Hyderabad City and out of these 37 were found to be infected. The worms occur in nodules in the wall of the stomach. When extracted out of these nodules they are blood-red in colour but turn white after fixation.

The mouth of the worm is surrounded by 6 cephalic papillæ and leads into a buccal capsule which measures 0.05 mm. in length. There are 6 well-developed tooth-like processes projecting into the buccal capsule (Fig. 1). The œsophagus consists of a short



Fig. 1.

Diagrammatic representation of the mouth, surface view.



Fig. 2.

Posterior end of the male showing the right spicule, a part of the left spicule, a pair of spine-like process, caudal alæ and the papillæ.

narrow muscular portion and a long, wide glandular part. Its total length is 2.6 mm.

The females are 25 to 40 mm. in length. The vulva lies in front of the posterior end of the œsophagus and is situated at a distance of 1.5 mm. from the anterior end.

The males are 16 to 26 mm. long. They possess caudal alæ and in the mature males

* The Species is named after Geheimrat Prof. Dr. O. zur Strassen of the University of Frankfurt-on-the-Main, Germany.

there are 7 pairs of pre-anal and 3 pairs of post-anal pedunculated papillæ. Near the tip of the posterior end there are two spine-like processes. The spicules are very unequal. The right spicule measures 0.45 mm. and the left 2.7 mm. in length.

These new nematodes belong to the family *Spiruridae* (Oerley, 1885), sub-family *Spirurinae* (Ralliet, 1915). They exhibit some affinities with the genus *Spirocercus* (Ralliet and Henry, 1911) but differ from it markedly and necessitate the creation of a new genus.

The distinguishing characters are as follows:—

(1) Unlike the genus *Spirocercus* in this new genus there are 6 well-developed tooth-like processes projecting into the buccal capsule.

(2) In the males instead of 4 pairs of pre-anal and 2 pairs of post-anal pedunculated papillæ there are 7 pairs of pre-anal and 3 pairs of post-anal papillæ to be found.

(3) The large medium papilla so characteristic of the genus *Spirocercus* is absent here.

(4) Instead of 4 or 5 pairs of minute papillæ at the tip of the posterior end, a pair of spine-like process is present.

The anatomy and life-cycle of this new Nematode will be published elsewhere.

I express my gratefulness to Dr. C. F. Chenoy, Special Plague Officer, Hyderabad City, for giving me all the facilities for the collection of worms.

SATYA NARAIN SINGH.

Zoological Laboratories,
Muslim University,
Aligarh, U.P.
January 20, 1934.

The Melting Point of a Certain

Aminodimethoxybenzoylpropionic Acid.

IN connection with the note¹ on this topic recently communicated by Dr. J. N. Ray, it must be at once observed that further experience with the acid in question has shown that its behaviour on heating varies in a somewhat capricious fashion. It depends to some extent on the way in which the sample is dried, and also on the rate of heating. If rapidly heated, the m.p. appears to be approximately 120° in confirmation of Haq, Kapur and Ray (*J.C.S.*, 1933, p. 1087), but if the pure dry acid is heated slowly it

¹ *Curr. Sci.*, 2, 247, 1934.

only sinters at this temperature, hardens again, and melts at various temperatures from 130° to 145° , depending on the conditions of heating. In many cases it is difficult to observe the sintering, and with the technique employed by Miki and Robinson (*J.C.S.*, 1933, p. 1467) the m.p. was found to be 141° . The dehydration of the acid, with the formation of the lactam, evidently occurs on melting, but it is not complete when a specimen of the acid is merely heated in a capillary tube to its point of fusion. It is doubtful whether this acid can be stated to have a melting point which is a physical constant characteristic of its molecular species, and probably all the observed melting points have to do with a substance undergoing more or less decomposition. With Dr. Ray's remarks on the formation of a 7-ring lactam in many cases, the present writer is in complete agreement. However, the acid employed by Miki and Robinson was never melted, and consisted entirely of the amino acid, as shown by its ready solubility in aqueous sodium carbonate and dilute hydrochloric acid, as well as by its diazotizability and by the colour reaction with ferric chloride. It is with amino acid of this kind, and not with the decomposed fused amino acid, that we failed to confirm the condensation to a quinoline derivative, using as second component acetaldehyde under the conditions described by Haq, Kapur and Ray.

Admittedly we made only one experiment, in which, however, we recovered the amino acid unchanged.

In regard to the question of the condensation of the aminodimethoxybenzoylpropionic acid with acetylacetone, and with dibenzoylmethane, Dr. Ray has not quite correctly represented our views on the subject. Miki and Robinson (*loc. cit.*) express no view as to the constitution of these substances, but merely pointed out the necessity for fresh experimental evidence. It will be simplest to reproduce the paragraph of our paper dealing with this subject:—

"Haq, Kapur, and Ray (*loc. cit.*) condensed aminoveratroylpropionic acid with acetylacetone and isolated a product, m.p. 245° . Similarly, the quinolines from aminoveratroylpropionic acid and acetophenone and dibenzoylmethane had m.p.'s 231° - 232° and 229° respectively. Carbon and hydrogen estimations are required in order to confirm the view taken of the constitution

of the products from acetylacetone and dibenzoylmethane, because the possibility of loss of an acyl residue exists and has not been experimentally disproved."

R. ROBINSON.

Dyson Perrins Laboratory,
University of Oxford,
January 23, 1934.

Chlamydonema fuelleborni n. sp.*

ONE male and nine female specimens of the genus *Chlamydonema* were obtained from the stomach of a domestic cat—*Felis catus domesticus*. The measurements were taken when the worms were alive.

The females measure from 30 to 45 mm. in length and 1.67 to 1.78 mm. in breadth. The body is attenuated anteriorly and the posterior end is enveloped by a reduplication of the cuticle which in the females measures 1.35 mm. from the tip of the tail. The cuticle is transversely striated and reflected over the lips. The cervical papillæ in the male measuring 30 mm. in length are at a distance of 1.16 mm. from the anterior end (Fig. 1). In all the nine females the

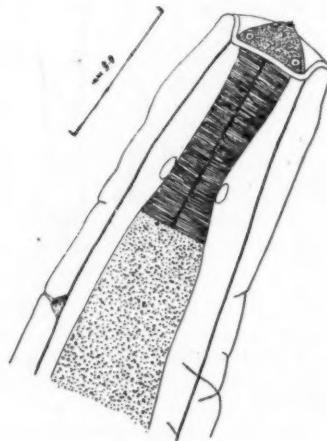


Fig. 1.

Anterior end of male showing the cephalic papilla.

vulva is surrounded by a detachable chitinous ring. In a female 3.5 mm. long, the vulva lies at a distance of 1.15 mm. from

* Species named after the late Geh. Medizinalrat Prof. Dr. Fredrick Fuelleborn, Director, Institut fuer Schiffs-u. Tropenkrankheiten, Hamburg, Germany.

the cephalic end. The lips and genitalia closely resemble those of *C. præputialis* and *C. masoodi*.

In the male specimen the posterior part of the œsophagus is constricted to a length of 0.93 mm. before it opens into the intestine (Fig. 2). This character is not noticeable in the females and as our observations depend only on a single male specimen, though preserved in an ideal condition, we do not give it any importance until more material is obtained and examined.

The posterior extremity of the male is not entirely enveloped by the reduplication of the cuticula. A little part of the caudal end remains exposed.

As usual there are four pairs of well-developed circumcloacal papillæ. Just above the anus there is a group of three pre-anal ventral papillæ in a line. The middle papilla is the largest. Behind the anus there are two pairs of post-anal ventral papillæ situated in a line. All these four papillæ are small and equal in size. Further down the tail there are four pairs of caudal papillæ. Pairs Nos. 1 and 2 are situated near each other on the anterior part of the caudal end and lie a bit farther off from pairs Nos. 3 and 4, which are situated near each other on the posterior part of the caudal end. The last pair, viz., Papillæ No. 4, are the largest of all the caudal papillæ (Fig. 3). The spicules are unequal, slender, curved and pointed. The left spicule measures 2.89 mm. and the right one 0.81 mm. in length.

We take this opportunity to express our sincere thanks to Dr. Asa C. Chandler, Rice Institute, Houston, U.S.A., for sending us two specimens of *C. præputialis* which he found in a domestic cat at Calcutta. We could not investigate this material thoroughly as the specimens have shrunk to a great extent and moreover both of them happen to be females. The lips and genitalia have, however, a close resemblance with those of

C. præputialis but in the absence of a male the species cannot be determined.

Four species of the genus *Chlamydonema* have been described so far. This new species discovered by us differs from those already described in the arrangement of the ventral post-anal and caudal papillæ. *Chlamydonema masoodi* (Mirza, 1933), possesses three caudal papillæ arranged transversely in a row. *C. præputialis* (von Linstow, 1889, Hegt, 1910), possesses one pair immediately behind the anus, three papillæ towards the tail end and an additional pair in front of these three. Ortlepp in describing the same species mentions that just behind the anus, one pair immediately following the other, there are three pairs of ventral papillæ and that two additional

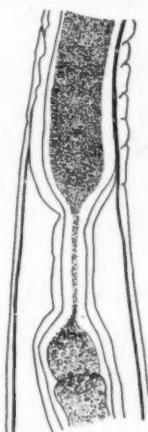


Fig. 2.

Posterior part of the œsophagus of male showing the constriction and a part of the intestine.

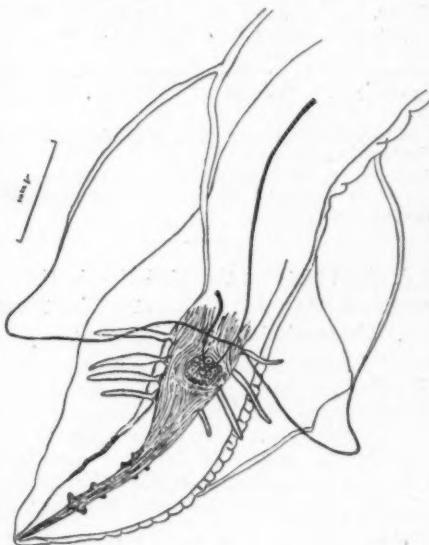


Fig. 3.

Posterior extremity of male, ventral view. The reduplication of cuticula is raised up in order to expose the papillæ.

pairs are found further down the tail. *C. malayensis* (Ortlepp, 1922), has only three pairs on the tail, in addition to this the size of the spicules also differs from our specimen. *C. tumefaciens* (Henry & Blanc, 1912), has five pairs of post-anal ventral papillæ, each pair is situated one behind the other.

The arrangement and size of the three pre-anal ventral papillæ in our specimen are just the same as those distinguishing

C. praeputialis, *C. malayensis* and *C. tumefaciens* but the arrangement and size of the caudal papillæ differ markedly from those of the above four species as already described.

The specimens have been deposited in the Museum of the Zoological Laboratories, Muslim University, Aligarh, U.P., India, under No. 1001.

M. B. MIRZA.

Zoological Laboratories,
Muslim University, Aligarh,

January 25, 1934.

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A Short Note on the Variation in the Strength of Reception of Calcutta Short-wave Transmissions at Chittagong.

THE Calcutta short-wave broadcast is received here with excellent strength and very good quality in the morning and noon, on every occasion. But in the evening, the reception is generally weak, sometimes amounting to no signal at all. The distance of Chittagong from Calcutta is about 200 miles.

The various characteristics of short-wave propagation are explained by assuming the existence of ionised layers in the atmosphere. The first or E layer is at a height of about 90 kilometres, where the ionisation is produced by the ultra-violet radiation from the sun. The short-waves pass through this layer with slight absorption. The paths of the waves are bent in the more strongly ionised F layer, which is at a height of about 250 kilometres. The variation of the ionisation with height at any part of the atmosphere is called the 'ionic gradient' which depends on the amount of radiation from the sun. It has been established that the bending of the short-wave rays is directly

proportional to the ionic gradient, and inversely proportional to the frequency. Thus for a given wave-length, the bending is greater at day-time when the sun shines, and less during the night.

It seems that for Calcutta short-waves (49.1 m.?) the ionisation in the F layer during the day-time is sufficient to return the rays to earth at this distance, so that the signals are quite strong. At night, on the other hand, the bending diminishes to such an extent that sometimes Chittagong falls within the skip zone and the reception is very poor at this place.

A. C. SAHA.

Chittagong College,
Chittagong, Bengal,
January 31, 1934.

An Attempt to Govern Sex Realisation in the Rabbit.

INVESTIGATION of the sex problem from the genetical and general biological point of view may be divided into two parts. First, there is the question as to which elements participate in the determination of sex and whether these may be experimentally governed before sex determination. Secondly, there is the question as to which factors participate in the realisation and manifestation of sex, and whether it is possible to govern such factors experimentally after sex determination but during the period of sex realisation.

According to modern cytogenetics female and male sexes are results of definite chromosomal combinations. Certain combinations of sex chromosomes together with the autosomes are responsible for the determination of males, females and intersexes. The latter can also be conditioned by quantitative genetic factors in various degrees as in *Limnaria*. The cytogenetic investigations indicate that the male sex in *Mammalia* contains the heterochromosomal pair, consequently it forms two types of gametes (spermatozoa); one type, the YA, determines the male sex and the other, the XA, determines the female sex. The female organisms, however, form only one type of gametes (egg cells) with the chromosomal constitution XA. Sex determination therefore occurs at the moment of fertilisation; a female (XXAA) is determined if an egg cell is fertilised with an XA spermatozoan and a male (XYAA) is determined if fertilisation is effected by a YA spermatozoan. To

govern sex determination then it is necessary either to eliminate one type of spermatozoa by killing or paralysing it so that only the other type remains active, or to separate in some other manner the two types so that one or the other alone may be used for fertilisation. Attempts to separate the XA from the YA type of spermatozoa have recently been reported as having been carried out by Koltzov using an electric current. In his experiments the XA tends to move to one of the poles and the YA to the other.

What then controls the realisation of sex and can we govern the factors acting during this period of sex realisation?

Results of the recent investigations in the field of physiology of development, including those of the endocrinological and transplantation experiments, show that after sex determination there is a long chain of interacting developmental processes which result in the formation of definite sex organs and glands that secrete hormones which in turn play their part in sex realisation.

When we ask whether it is possible to govern the development of sex we question whether we can in some manner govern some of the developmental processes so that from a XXAA determined organism a male develops or from a XYAA determined organism a female develops. The former type of experiments seem more difficult than the latter because the XXAA constituted organism does not have Y-chromosomes, while a XYAA chromosomal constitution has the characters carried by both X and Y chromosomes. Therefore, attempts to

influence the developmental processes of a XYAA organism and to direct them towards realisations of a female organism seem more reasonable. This might be done either by forcing the processes directed by X or by suppressing those directed by the Y (*i.e.*, the XAA and YAA components respectively). In our experiments we chose the latter way. From the works of Abderhalden's school² we know that after immunisation with proteins or peptones having complex molecules from certain organs or tissues, age specific and sex specific "Abwehrfermente" are induced as well as the species specific and *organ* specific "Abwehrfermente". Numerous immunological investigations have also shown that antibodies can pass through the placenta. Therefore, if we inject protein from rabbit testes into a fertilised female rabbit we can expect that "Abwehrfermente"³ can be induced in the female rabbit against the testicular proteins and that these by passing through the placenta may act upon the embryos. If male embryos (XYAA) are present the antibodies might conceivably act against the developmental processes directed by the Y-chromosomes and destroy the products of the latter (more exactly, destroy the testicular proteins of the male embryos). Thus, if the male characters are suppressed it may be supposed that female characters will predominate so that from a XYAA determined organism an apparent female might develop.

A series of such experiments were carried out and the results are summarised in Table 1. The sex ratio in the controls is given in Table 2.

TABLE 1.

No.	Date of mating	Date, type and amount of I injection	Date, type and amount of II injection	Date, type and amount of III injection	Male	Female	Ab-normal
1	1931 14/III	14/III. 1 gr. rabbit testes tissue + 10 c.c. distilled water crushed together; injected 8 c.c. suspension.	21/III. 2 gr. dry tissue from rabbit testes + 20 c.c. water. Rabbit No. 1 injected 4½ c.c. No. 2 injected with 5½ c.c. suspension.	30/III. 1.5 gr. tissue of rabbit testes + 15 c.c. water. Injected suspension in No. 1, 5 c.c., in No. 2, 5 c.c. too.	2	5	1
2	"	14/III. 1 gr. tissue of bull testes tissue + 10 c.c. distilled water, injected 8 c.c. suspension.					

¹ Recent investigations have shown that the Y-chromosome is not devoid of characters as previously supposed, but also contains genes.

² Abderhalden, E. und Buadze, S. 1931. Fermentforschung 13: 137 and 13: 166.

³ The cytological and histological investigations of implanted testes in female rabbits showed that a very rapid cytolysis occurs in the testicle tissues (Kostoff and Rajably, 1933. Irregular Spermatogenesis and cytolysis in rabbit testes under various conditions). (*In press.*)

No.	Date of mating	Date, type and amount of I injection	Date, type and amount of II injection	Date, type and amount of III injection	Male	Female	Ab-normal
3 4(2)*	18/VII "	20/VII. 2 rabbit testes crushed with 15 c.c. and left for two hours. The swimming particles dropped at the bottom. 5 c.c. clear extract injected in No. 3 and 5 c.c. in No. 4.	..	..	4	6	
5 6 7(1)	24/VIII " "	25/VIII. Two testes crushed in 20 c.c. water. Each rabbit injected with 5 c.c. suspension.	29/VIII. Injections repeated as at 25/VIII.	..	7	8	3
8	26/VIII	27/VIII. Injected with 5 c.c. suspension preserved with chloroform under toluol from 25/VIII.	29/VIII. As above.	..	2	3	
9(3)	12/IX	This was a female rabbit in which a testes was implanted subcutan at the left ventral side at 3/IX.	..	..	1	4	
10	12/IX	12/IX. Injected with 5 c.c. suspension of a crushed rabbit testes in 20 c.c. water.	16/IX. Injected with 5·5 c.c. suspension of a dry rabbit testes +20 c.c. water 16/IX. Each received 5·5 c.c. as above.	..	2	4	
11 12(2)	14/IX "	14/IX. Injected with extract prepared at 12/IX and preserved in chloroform.	..	..	3	2	
13	23/IX	23/IX. Injected with 5 c.c. suspension prepared from one rabbit testes +8 c.c. water.	..	..	2	3	
14 15	27/IX "	27/IX. Each injected with 5 c.c. suspension from 3 rabbit testes +22 c.c. water.	2/X. Each injected with 5 c.c. suspension preserved by chloroform from 27/IX.	8/X. Each injected with 5 c.c. suspension from 1 testes +12 c.c. water. Altogether ..	3	6	1
					28	45	5

TABLE 2.

No.	Born at	Male	Female	No.	Born at	Male	Female
1	10/IV	3	2	8 (4)	B.F.	20	20
2	30/IV	6	6	9 (2)	18/VII	5	6
3	"			10	30/VII	3	2
4	22/V	3	4	11	24/VIII	4	5
5(1)	12/VI	2	3	12 (6)	"	2	4
6	27/VI	3	2	13	15/IX	3	3
7(3)	8/VII	3	3	14 (3)	21/X		
	C.O.	20	20		Altogether ..	37	40

* The numbers given in parenthesis as for example " (2) " mean that rabbit No. 2 appears now as No. 4.

Treated pregnant rabbits together with rabbit No. 9 (in which an implantation was made of testicular tissue rather than an injection) gave 28 males, 45 females, and 5 abnormal individuals. The latter had relatively small penes and testes. The testes were about the size of a pea grain when these animals were dissected at an age of 70 to 100 days. If animal No. 9 is excluded (Table 1) then there were 27 males, 41 females and 5 abnormal individuals among the progeny. In the control animals there were 37 males and 40 females. I am personally not satisfied with the subject used (rabbit) or with the results obtained. The difference between the treated and untreated animals is not very great, but it is suggestive enough to warrant carrying out further experiments. The abnormal individuals may prove to be of great interest from the developmental point of view.

The results given here are therefore far from conclusive, but I am reporting them because at the present time I am engaged with other experiments and cannot continue them further though I think they indicate possible interesting results if more extensively pursued. Governing the sex realisation and manifestation is of scientific significance and may also prove to have practical applications. The swine or dog might prove a better object for experimentation than the rabbit since they have a longer period of gestation and thus would allow for better immunisation of the maternal organism before the beginning of testicular development in the embryos. These animals also bear no less than the rabbit and the gestation period is not too long to give satisfactory time for investigations. Should such immunisation by organ or tissue suspensions or extracts of pregnant animals prove successful for influencing the development of embryos they may help in attacking numerous developmental problems.

DONTCHO KOSTOFF.⁵

Genetical Laboratory,
Academy of Sciences,
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January, 1934.

Rydberg's Potential Energy Function and Transition Probabilities.

WHILE examining by graphical construction, the correctness of potential energy curves

⁵ The author is indebted to Mr. B. Tranoff for help throughout the investigations here reported.

for diatomic molecules with the aid of effective integral and B_v values, Rydberg¹ has proposed a modified function of the following form:

$$U(r) = D (ax + 1) e^{-ar}$$

This he has found to agree better than Morse's function in the case of H_2 , CdH , and O_2 .

During my recent work in London on the quantitative estimation of band intensities in the second positive system of N_2 , I thought it desirable to examine this function for vibrational transition probabilities. I have derived these theoretically by Morse's as well as Rydberg's functions. From the accurate experimental data of intensities, I have calculated the vibrational transition probabilities by producing the bands in four different sources varying widely in temperature and electrical conditions. The Condon parabola of maximum probabilities on the basis of Rydberg's function has been found to give a much closer approximation than Morse's, with experimental values in all the cases studied. This can be understood from the Table A given below, where the theoretical and experimental results of maximum probabilities are compared. These have been

TABLE A.
Maximum Probabilities.²
Positive Column.

Theoretical		Experimental
Morse (1)	Rydberg (2)	(3)
(0, 0)	(0, 0)	0, 0
(1, 0)	(1, 0)	1, 0
(0, 1)	(0, 1)	0, 1
3, 1	(3, 1)	2, 1
(0, 2)	(0, 2)	0, 2
4, 2	4, 2	3, 2
(0, 3)	(1, 3)	1, 3
—	—	4, 3
1, 4	(2, 4)	1, 4
1, 5	(3, 5)	2, 5
2, 6	(3, 6)	3, 6
3, 7	(4, 7)	4, 7
3, 8	—	—
4, 9	—	—

¹ Rydberg, *Zeit. f. Phys.*, **73**, 376, 1931.

² The numbers in the table are bands where maximum probabilities have been located.

derived by reading the quantum numbers of bands on or in the immediate vicinity of Condon parabolas. The agreement has been judged graphically by the closeness of theoretical and experimental curves. Those bracketed in columns (1) and (2) denote close agreement with experimental determinations. It may be noted that $r_{\min} \rightarrow r_{\min}$ transitions in the case of Morse function have been found to be relatively far away from the experimental parabola. To avoid unnecessary details, only the results of positive column in discharge tube have been given herewith. Nearly similar results have been obtained with other conditions of excitation.

It is interesting to note that Johnson and Dunston* working independently on the intensities of BeO bands, have arrived at the same conclusion. The detailed results will be published elsewhere.

N. R. TAWDE.

Royal Institute of Science,
Physics Laboratories, Bombay,
January, 1934.

* Johnson and Dunston, *Phil. Mag.*, **105**, 472, 1923.

On Stellar Ionisation.

In a previous note¹, expressions were given for stellar ionisation for the relativistic as well as for the non-relativistic case with electrons in the degenerate and the non-degenerate state. It was pointed out that with the total number density 10^{30} (electrons, ions and atoms taken together) ionisation is complete well within temperatures of the order 10^9 — 10^{10} . This is in line with the hypothesis of Fowler, Stoner and others², who, starting with the hypothesis of complete ionisation, arrive at the limiting density of White Dwarfs of the order 10^{22} — 10^{30} . This also accounts for the fact that in the calculation of stellar opacity,³ the bound-free transition does not make any contribution at all, for in a fully degenerate system there is no bound electron. We are also spared from making the paradoxical assumption with Chandrasekhar that electrons are bound as well as free.

Now in carrying out numerical calculations some interesting points arise. We consider for the present that stellar matter consists of hydrogen only. The results are given in the table.

Star	Temperature	Minimum No. of electrons for satisfying degeneracy criterion.	Percentage of Ionisation		No. of electrons calculated from ionisation			
			Degenerate		Non-degenerate		Non-degenerate	
			Non-Relativistic	Relativistic	Non-Relativistic	Non-Relativistic	Non-Relativistic	
Model Star $N = 10^{30}$	1×10^9	1.54×10^{29}	13.9	4.5	32.02	1.22×10^{29}	4.3×10^{29}	2.42×10^{29}
	2	4.34	32.8	32.0	44.58	2.47	2.42	3.08
	3	10.06	94.0	93.0	57.98	4.85	4.80	3.66
	4	12.27	Complete	Complete	65.10	5.0	5.0	3.94
Sirius B $\rho \sim 3 \cdot 10^6$ (Eddington)	1×10^9	1.54×10^{29}	17	..	..	2.55×10^{29}	..	..
$\rho \sim 3.97 \times 10^4$	7.2×10^9	40.12×10^{29}	Complete	..	..	1.8×10^{29}	..	..
O_2 -Eridani B. $\rho \sim 9.55 \times 10^4$	1.5×10^9	28.28×10^{29}	Complete	..	93.00	2.39×10^{28}	..	2.22×10^{28}
$\rho \sim 8.55 \times 10^5$	9.7×10^9	4.65×10^{27}	Complete	..	..	8.45×10^{27}	..	..
$\rho \sim 10^{10}$	4.0×10^{10}	4.0×10^{30}	Complete	..	..	5.14×10^{20}	..	..
Chandrasekhar's Model $N \sim 7 \times 10^{29}$	1.4×10^9	2.55×10^{29}	..	15	..	9.2×10^{29}	..	..
Star with limiting $\rho \sim 5 \times 10^8$	5×10^9	1.32×10^{30}	2.90	..	45	8.7×10^{30}	1.34×10^{30}	..

¹ Ganguli, *Curr. Sci.*, **1**, Dec. 1932.

² Fowler, Stoner, etc., see ref. 1.

³ Chandrasekhar, *Proc. Roy. Soc.*, **133A**, 241, 1931; Kothari and Majumdar, *A.N.*, **244**, 146, 1931.

⁴ Chandrasekhar, *L. F. Astrophys.*, **3**, 306, 1932.

⁵ Chandrasekhar, *Monthly Notices, R.A.S.*, **91**, 446, 1930.

⁶ Stoner, *Ibid.*, **92**, 662, 1932.

It is evident from the table that in most cases the number of electrons calculated from the degree of ionisation for the degenerate case does not satisfy the degeneracy criterion.[†] On the other hand, the number of electrons calculated from the degree of ionisation for the non-degenerate case for these very stars, leads to degeneracy. This is true for the models considered and also for Sirius B and O₂-Eridani B.

This incipient degeneracy may be avoided with higher electron density corresponding to the given temperatures. Actually, since all stars contain, besides hydrogen, several poly-electronic atoms such as Ca and Fe, the electron density may be expected to be much higher than what is computed here. For these cases, successive ionisation should be taken into account. But since in all cases, ionisation potential affects but little the degree of ionisation in the degenerate case, it may be shown that in this case as well complete ionisation is attained within T=10¹⁰ for N~10²⁰.

A. GANGULI.

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January, 1934.

On Transport Phenomena in Degenerate Gases.

RECENTLY Kothari and Uehling and Uhlenbeck² have studied the problem of transport in the new Quantum Statistics and have deduced values for viscosity, conductivity and diffusion. We have used Maxwell's method³ modified by Fermi-Dirac Statistics and have obtained the results of Chapman for the fifth power law in the generalised form. We find the hydrodynamical equation of continuity for the steady state in the same form as in the classical case and the adiabatic gas law

$$\lambda n^{-\frac{2}{3}} = 0 \text{ where } \lambda = \frac{p}{\rho}$$

$$\text{or } p\rho^{-\frac{2}{3}} = \text{Const.}$$

[†] This has been kindly pointed out to me by Dr. Chandrasekhar in a private communication.

² Kothari, *Phil. Mag.*, **13**, 361, 1932; *M.N.*, **92**. Uehling and Uhlenbeck, *Phys. Rev.*, **43**, 552, 1933.

³ Jeans, *Dynamical Theory of Gases*, 4th Edn. (Cambridge), Chap. IX, p. 231.

Chapman, *Phil. Trans.*, **216A**, p. 279, 1915; **217A**, p. 115, 1916.

is valid for the degenerate or the non-degenerate case. The expressions for viscosity, diffusion and conductivity are respectively as follows:

$$k = \frac{p}{\mu n}, \quad \theta = akC_c,$$

$$D_{12} = \frac{p}{n} \cdot \frac{1}{m_1 m_2 A_1 (n_1 + n_2)} \sqrt{\frac{m_1 + m_2}{k}}$$

$$\text{and } D = \frac{3A_2 pm}{\mu p^2 A_1}$$

$$\text{where } \mu = \frac{3}{2} \sqrt{2mk}, A_2.$$

A₁, A₂ and k have the same significance as in the classical theory, a=5 for the classical theory and $\frac{15}{16}$ for the degenerate state.

In order to apply this to electrons and protons in the stellar interior we have to use the law of inverse square. Instead of using Chapman's method³ we have used the more rigorous method due to Perisco⁴ and we obtain expressions for viscosity, etc. in the same form with modified value of $\mu = \frac{3}{2} VA_2$ where,

$$A_2 = \pi \int \sin^2 \theta' p dp,$$

V is the average velocity, and

$$A_1 = 4\pi \int \cos^2 \theta' p dp.$$

Calculations for A₁ and A₂ are made for O₂-Eridani B with density 9.8×10^4 gm./c.c. and T=10⁸, and assuming this to contain completely ionised Ca atoms. The values of viscosity, conduction and diffusion are given below.

$$k = 11.65, \theta = 1.952 \times 10^{15} \text{ and}$$

$$D = 2.286 \times 10^2.$$

Calculations for other stars are being carried out and the significance of these values to stellar models will be discussed elsewhere.

A. GANGULI.
P. MITRA.

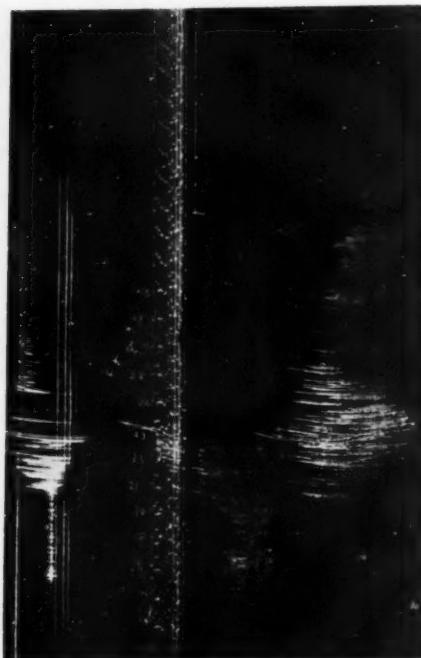
Science Laboratory,
College Dupleix,
Chandernagore,
January, 1934.

³ Chapman, *M.N.*, **82**, 291, 1922.

⁴ Perisco, *M.N.*, **86**, 93, 1925.

Seismographic Record of the Recent Earthquake.

FROM a photograph of the Seismogram obtained in Mangalore on January 15th, 1934, it may be seen that the movement began at 14 hrs. 17 mins. It continued till



after 15 hrs. (S. T.). The first phase is well marked in the vertical component (extreme left), not so well marked in the two horizontal components. $S - P = 3$ mins. 20 secs. which according to Zeissig's Tables, gives an epicentral distance of 2,000 Km. (see Galitzin's *Vorlesungen über Seismometric*, Leipzig, 1911, p. 108). *The Travel Times of Earthquake Waves* published by the Department of Geophysics, Saint Louis University (Nov. 1933) gives a distance of 1,935 Km. This would fix the epicentre within a circle of some 50 Km. radius from Khatmandu (Nepal). The epicentral determination, however, cannot usually be done from data obtained at a single station. In the present case the determination is all the more uncertain that the first tremors are not well marked by the horizontal components. The maximum amplitude marked by the E-W component is 10·4

cms., at about 14 hrs. 23 secs., when the needle broke. Double amplitude is measured, very remarkable is the amplitude of the vertical component. If the jumping of the ground was so pronounced at a distance of 2,000 Km., what must it have been near the epicentre? The St. Louis distances are applicable only to earthquakes whose focal depth is 10-15 Km. They form so numerous a class as to deserve to be called "normal earthquake". The agreement of the measured with the calculated epicentral distance makes me think that the hypocentre of the earthquake of January 15, would not have been much deeper than 10 or 15 Km. Of course, only a study *in situ* can settle the question.

D. FERROLI.

St. Aloysius' College,
Mangalore,
February 3, 1934.

Organic Manures and Soil Structure.

THE beneficial effect of organic manures in improving the tilth and increasing the absorptive and water-holding capacities of soils has long been known. Their utility as sources of plant and microbial food has been recognised and, more recently, evidence has also been adduced to show that they supply a part of the carbon-dioxide assimilated by the plant.¹ No information is available, however, regarding the effect of their decomposition on the ultimate mechanical composition of soils: indeed, they are not supposed to have any effect at all.

In the course of an investigation on nitrogen transformations in swamp soils, it was observed that soils treated with organic manures tended to become increasingly heavy with the progress of the decomposition. This observation, combined with a few others, such as increased difficulty in 'dry' digesting such specimens for estimation of nitrogen, suggested that the treatments had brought about some permanent change in the physical texture of such soils.

With a view to obtaining some quantitative evidence regarding the nature and extent of such transformations, specimens (40 lbs.) of a local soil (red loam) were made up, in the usual way, in glazed earthenware pots and treated as follows:—(a) unmanured and

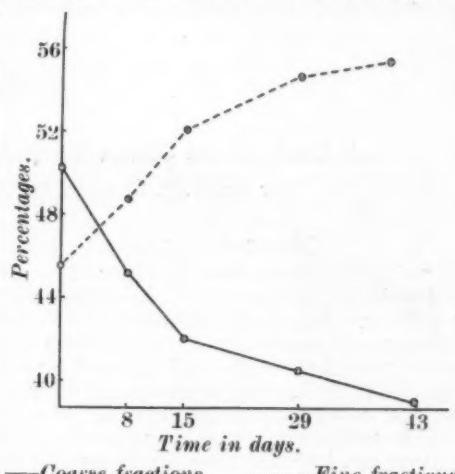
¹ *Nature*, 132, 1001, 1933.

maintained at 60 per cent. saturation with regard to water; (b) green manured with the leaves of *Pongamia glabra* at 100 g. per pot and maintained at 60 per cent. saturation; (c) unmanured and swamped to a depth of 3 inches; and (d) green manured as in (b) and swamped as in (c). At convenient intervals the contents of the pots were removed in three-inch layers and their mechanical composition determined according to the International Method after destroying organic matter by treatment with hydrogen peroxide.

The results showed that in none of the cases was there any perceptible effect on the composition of the soil below the first three inches. The surface layers of the unmanured specimens were not also appreciably altered. On the other hand, the green manured soils showed a significant change with the decomposition of the organic matter. This was particularly so in the case of the waterlogged specimens in the first three inches of which the coarse fractions (coarse and fine sand) showed a distinct fall while the fine ones (silt and clay) showed a corresponding rise.

The mechanism of the above change is still not fully understood. There is evidence, however, to suggest that the formation of organic acids and the attendant solubilisation of minerals, particularly silica, is, in

some way, connected with the increase observed in the case of the finer fraction.



Further work is in progress to throw more light on the above and related phenomena.

A. SREENIVASAN.
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Bangalore,
February 6, 1934.

Loch Ness Monster.

THE belief in the existence of weird creatures is a survival of the dark ages in which the credibility of the people outstripped their understanding and imposed no restrictions on the acceptance of exaggerated accounts of fire-snorting dragons and outlandish monsters. If now and then reports of the occurrence of such strange animals arrive, it is because there are still people whose mind is not sufficiently enlightened to discern and discriminate. Judged by the reports of this modern monster, he is obviously an enormous reptile whose compatriots ceased to exist towards the beginning of the Tertiary period of the Earth's history, for they had reached a complexity of organisation which rendered them incapable of adapting themselves to the new conditions of environment introduced by

this period. Those which still possessed that power of adaptation survived as in the case of Sphenodon and it is impossible to conceive of a gigantic Pythonomorph capable of adjusting itself to the new altered conditions of existence or escaping from the more agile enemies. A stray animal, even if it were prehistoric, by which popular writers mean of times before man began to chronicle public events, cannot continue to live indefinitely but must imply the existence of his family and tribe hidden somewhere in the still unexplored regions. Such haunts will not remain long concealed from the scientists, sportsmen, explorers and cinema directors and the only value of the reported occurrence of a monster in Loch Ness is to provide a subject for excited talk in social circles. The scientist wants the evidence

of the animal itself, dead or alive, and after dissection would be able to pronounce his verdict as regards the monster's

age, pedigree, relationship and value. The monster may prove a commonplace seal or whale.

A Study of the Citrus Varieties of the Bombay Presidency.

By Dr. G. S. Cheema, D.Sc., I.A.S., and S. S. Bhat, M.Ag.

INTRODUCTION.

IN order to advance the horticultural possibilities of any tract, it becomes imperative to obtain first-hand knowledge of the existing local conditions of fruit cultivation. A study of all the different local varieties of a group of fruits and their adaptability to the local conditions of soil, climate, etc., is only a preliminary necessity before any attempt can be made towards improvement.

The Presidency of Bombay produces many kinds of fruit of genuine quality. A number of varieties of the citrus group are cultivated here "par excellence". Many foreign types are also being annually introduced by State agency or private enterprise. Some of the local varieties seem to be firmly occupying their ground in point of quality and production. They are perhaps above competition by the new comers. There are also introduced varieties of citrus which may, in course of time, establish themselves as superior in quality and thus gain popular favour. Such varieties may not oust the established local types, but they may occupy new ground side by side with them. There is also considerable confusion about the identity and classification of the local varieties of citrus, when they are compared with those mentioned in foreign literature. This fact presents an almost insurmountable difficulty not only to the student of horticulture, but even to the enterprising grower, who tries to import new types from outside. A free exchange of suitable varieties of citrus is thus much hindered.

An attempt is therefore made in the following pages to assign to the local types of citrus their proper place in the different schemes of classification of citrus attempted by several authors.

THE VARIETIES OF CITRUS OF THE BOMBAY PRESIDENCY AND THEIR IMPORTANCE.

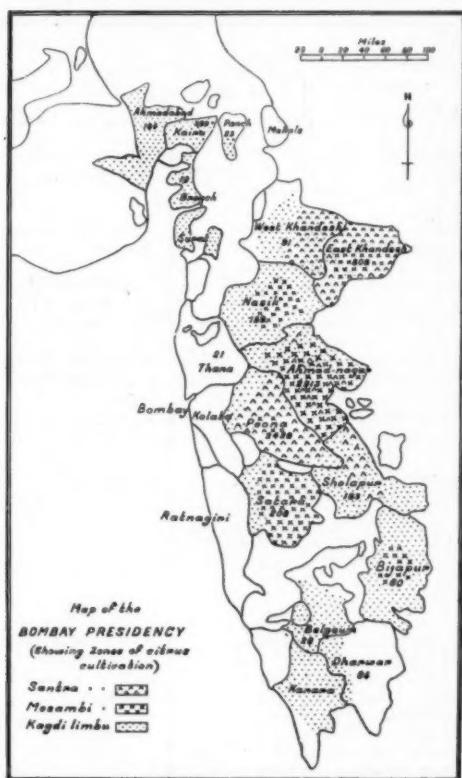
There are a large number of varieties of citrus found growing in this Presidency.

Their cultivation is restricted to particular zones only, which are suitable from the point of view of soil, climate, and other conditions, such as facilities for irrigation. The important varieties of this Presidency are the oranges (Santra and Mosambi types), the lime (Kagadi limbu) and the pomelo and the citron group. These varieties are not all found occupying the same zones. They are more or less distributed severally according to suitable conditions. In fact, the oranges and the lime are alone cultivated on plantation scales. The other types are mostly seen scattered as individual trees in the regular plantations of the above varieties.

The total acreage of citrus cultivation in this Presidency comes to about 7,500 acres. The two types of oranges (Santra and Mosambi) alone occupy nearly 5,000 acres of this area. Their distribution is restricted to the Poona (2,198 acres), the Ahmednagar (2,611 acres), and the East Khandesh (671 acres) districts. The other districts have practically very little area under oranges. Then comes the lime (Kagdi limbu) which occupies about 1,700 acres on the whole. Its cultivation is more extensively distributed than that of the oranges. The lime occupies about 400 acres in the Kaira, 300 acres in the Ahmednagar and 250 acres in the Poona districts. The districts of Nasik, East Khandesh, Ahmedabad and Bijapur have about 100 acres each under lime. Beside these there are not less than nine other districts which have lime cultivation on a smaller scale. The pomelo stands last in point of acreage under cultivation, occupying only 23 acres in the Presidency. It is mainly cultivated in the Thana and Kolaba districts although there are odd trees of pomelo almost everywhere, especially in the coastal tract near Bombay (see map in the next page).

From this it will be seen that while there are not less than 20 distinct local varieties of citrus, it is only three or four of them

that are of economic importance at present. They too are now grown in a limited number of districts. With the increase of facilities



of irrigation and transport, it is quite possible that their cultivation will be extended not only in the present citrus growing zones but also in new zones which may be formed in the Karnatak and elsewhere. It is not only the oranges, which are the important table varieties, that hold out this promise, but the lime seems to have a greater future especially with the development of the Lime Juice production industry.

We give in this paper a detailed study of our local varieties of citrus and try to classify them in different groups wherein they may be best fitted.

IDENTIFICATION AND CLASSIFICATION OF THE CITRUS FRUITS OF THE BOMBAY PRESIDENCY.

The present nomenclature of the citrus fruits of this Presidency seems to require a

revision when they are compared with those described and illustrated in foreign literature. Many of the local types have their own botanical names, which are locally approved, but they seem to be presenting considerable amount of confusion in finding out their exact prototypes in other countries. Of course, opinions widely differ on the point of the classification and identification of the citrus fruits even among the great American writers on these fruits. Coit² states in this connection: "No two systematic botanists appear to be agreed as to the proper classification of the many different species. This is probably due to the fact that several of the species hybridize readily, and it is very difficult to determine which of the forms are of hybrid origin." Not only this. The writers have observed different forms of fruits, which would appear to belong to different types of citrus, growing on the same tree in the case of some varieties of citrus. Bonavia¹ mentions examples of this nature with illustrations abundantly. He differs from Coit and states that a total change of climate, soil, and environment might effect still greater changes in the nature and appearance of the fruit, without any influence from hybridism and without the necessity of origin from a different species. This phase of our study becomes, therefore, greatly complicated and confusing. The desirability of a uniform nomenclature which may be acceptable to all the citrus growing countries of the world cannot be over-estimated. It seems to be, however, practically impossible to be achieved, because of the large number of new types which originate from time to time, the various local names for identical types, and the lack of sufficient communication between the workers of different countries.

An attempt is, therefore, made in these pages to study the various classifications offered by some of the most prominent writers on the subject. It is also intended to fit in our local types of citrus according to the most generally accepted classification and nomenclature. This indeed involves certain alterations in the locally approved botanical names of some of our types.

Bonavia¹ is perhaps the first botanist who made an extensive study of the citrus fruits of India. According to him our local types are named and classified as follows. (See Table No. 1.)

TABLE NO. 1.

*Digest of the Classification of Citrus Fruits of India and Ceylon as presented by E. Bonavia,
in his "The Cultivated Oranges and Lemons of India, etc."*

Main Group	Characteristics of Main Group	Sub-group	Characteristics of Sub-groups	Names of local types falling in these groups	Botanical Names
1. Oranges	Flowers white; fruit red, spherical, without a mammilla. (The author states that there is no good natural reason to take these points as characteristic of oranges.)	I. Sweet oranges : (a) Portugal, Malta, Naval, Mosambi. (b) i. Santra. ii. Keonla and Mandarins. II. Sour oranges : (i) Seville.	Tree spreading. Fruits close-skinned; taste more or less purely sweet. Tree slender, erect; fruit loose-skinned; juice of Santra is sweet well blended with sour; that of Keonla and Mandarins is more acid than sweet. Fruits are sour in taste, loose-skinned; more or less akin to Santra, except that Khatta and Karna may vary in size.	Mosambi, Naval and Malta oranges. Santra. Kavla, Ladu, Reshma, rangi. China orange.	<i>Citrus aurantium sinensis</i> , Gall. <i>C. aurantium sinense</i> , Rumph. Do. (<i>C. nobilis</i> of Laureiro is a synonym.) <i>Bigaradier chinois</i> .
2. Pomelos	" Petiole broad-winged; flowers large, white; stamens 16-24; fruit large, pale, globose, or pyriform, rind thick; pulp sweet or acrid."	i. Pulp red or pink. ii. White. iii. Pulp mixed, entirely yellow, or red-checked.	Do.	Pomelo, Shaddock or grape fruit (Papnas)	<i>C. bigaradier</i> Risso. <i>C. fusca</i> , of Laureiro. <i>Aurantium acid</i> of Ambuya. <i>C. vulgaris</i> , Risso or all synonyms. <i>C. aurantium</i> , var. Khatta, Bonavia. <i>C. decumana</i> Linn.
3. Citrons, Lemons and Limes.	" Young shoots glabrous, purple; leaflet glabrous; flowers often unisexual; petals generally more or less pink; fruit globose, ovoid, or oblong, often mammillate at the apex." " A shrub or small tree; leaflet 3-6 inches; elliptic-ovate, or ovate-lanceolate; petiole naked or winged; flowers 5-10 in a raceme, small or middle-sized; stamens 20-40."	i. <i>C. medica</i> proper. ii. <i>C. medica</i> var. <i>Bajoura</i> . iii. Sour : (Lemons) <i>C. medica</i> var. <i>limonum</i> . Sweet (lemon) : <i>C. medica</i> , var. <i>limetta</i> . iv. True limes.	" Leaflet oblong; petiole short, margined or not; flowers usually numerous; fruit large, oblong, or ovoid; mammilla obtuse; rind usually warted, thick, tender, aromatic; pulp scanty, sub-acid. Lemon-citron, and citron-lemon. " Leaflet ovate; petiole margined, or winged; fruit middle-sized, ovoid, yellow, mammillate, rind thin; pulp abundant, acid." " Fruit globose, 3-5 inches diameter; rind thin, smooth, juice abundant, sweet, not aromatic." " Leaflet elliptic-oblong; petiole many times shorter than the leaflet, linear or abovate; racemes short, flowers small, petals usually four; fruit usually small, globose or ovoid, with a thick or thin rind; pulp pale, sharply acid."	Mahalung. Jamburi and Id limbu. Sakhar limbu. Kagdi limbu (thin-skinned). Godhadi limbu (thick-skinned).	<i>C. medica</i> Linn. (<i>C. aurantium</i> var. <i>medica</i> of Brandis is synonym.) <i>C. medica</i> var. <i>Bajoura</i> . <i>C. medica</i> var. <i>limonum</i> . (<i>C. aurantium</i> var. <i>limonum</i> of Brandis. <i>C. limonum</i> Wall. <i>C. medica</i> , Will. are synonyms.) <i>C. medica</i> var. <i>limetta</i> or <i>limia</i> . (<i>C. limetta</i> Risso is synonym.) <i>C. M. acida</i> Linn. (<i>C. acida</i> of Roxburgh.)

Bonavia does not present any distinct scheme of classifying the citrus fruits. He only discusses the suitability of certain groups and critically examines certain distinctive characters. He devotes a chapter for almost every one of the sub-groups mentioned in the table. It is true that these are all considerably different from one another. All the same, they seem to fall under certain main groups, which are shown in the table.

Coit² in his book "Citrus Fruits" expresses the great difficulty of properly classifying

the various kinds of citrus fruits, and after studying the various schemes proposed, he offers the following "practicable working classification". Coit's scheme certainly gives a bird's-eye view of the important species of citrus. He does not enter into the details of the many sub-varieties of the species, but only groups them in general into broad specific groups. The following Table No. 2 presents Coit's classification together with the grouping of the Bombay citrus varieties under the different heads.

TABLE NO. 2.
Coit's Classification.

Botanical Name	American Varieties	Equivalent Bombay Varieties
<i>Citrus trifoliata</i> .	The deciduous orange <i>Poncirus trifoliata</i> .	<i>Citrus trifoliata</i> (wide tree).
<i>C. bergamia</i> .	Bergamot orange.	
<i>C. sinensis</i> .	Common sweet orange.	Mosambi, Naval orange, etc.
<i>C. aurantium</i>	Sour stock, seville or bitter orange.	Seville, Sylhet, Khatta orange.
<i>C. nobilis</i> .	The king orange. var. <i>deliciosa</i> —Mandarin oranges, etc. var. <i>unshiu</i> —Satsuma oranges.	Santra orange. Kavla, Ladu, Reshma narangi.
<i>C. decumana</i> .	The pomelo (grape-fruit), shaddock.	Pomelos (Papnas).
<i>C. japonica</i> .	Kumquats.	China orange. (?)
<i>C. medica</i> .	Citron of commerce.	Mahalung.
<i>C. limonia</i> .	Sour lemon, sweet lemon.	Jamburi, Id; Sakhar limbu.
<i>C. aurantiifolia</i> .	Sour lime, sweet lime.	Kagdi limbu, Godhadi limbu and Pat limbu.

Professor Tyozaburo Tanaka of Japan has offered a classification of the citrus fruits of the Eastern countries. He offers an elaborate scheme and remarks that more species may be recognised as knowledge of these fruits will gradually advance. In his opinion the earlier workers on classification worked only on superficial characters. He credits Dr. Swingle of having taken a long step towards a standard classification of citrus fruits in the scheme he has offered, consisting of nine definitely known species as the standard. Prof. Tanaka points out the mistake of taking Swingle's nine species as final and further states that "The faithful application of the type theory and the establishment of horticultural species admitted by the Vienna Code are the most important phases in completing the taxonomy of citrus fruits". He proceeds to say that in

classifying citrus fruits fundamental importance must be attached to essential characters only. Such are, according to him, the difference in inflorescence, elongation of anther and pulp vesicles, colour of the embryo, polyembryony or mono-embryony, etc. In elucidating these characters, Prof. Tanaka states: "Polyembryony generally prevails in *Citrus*, *Poncirus* and *Fortunella*, but mono-embryo is a distinctive character in Shaddock citron, lemon, Yuzu, Ichang lemon, and in certain loose skin oranges." Regarding this character, the experience of the present writers is somewhat different. In a germination trial, they have found that citron (Mahalung) and lemon (Jamburi) seeds have shown that a large percentage of them are polyembryonic. The importance of this character as of specific distinction in classification seems to be therefore doubtful

to the writers. Professor Tanaka's classification is given below together with an attempt to fit in the Bombay varieties according to it.

TABLE NO. 3.

Tanaka's Classification of Citrus Fruits and the Place of the Bombay Varieties.

Main Group	Varieties and their Botanical Names	Bombay Varieties falling in them
1. <i>Papeda.</i>	<i>Citrus Hystrix</i> DC. <i>C. macroptera</i> , Mont. <i>C. micrantha</i> , Wester. <i>C. Webberi</i> , Wester.	
2. <i>Lime.</i>	<i>C. aurantiifolia</i> (Christm.) Swingle.	Kagdi limbu, Godhadi limbu, Pat limbu.
3. Lemon-Citron.	<i>C. medica</i> , Linn. <i>C. medica gaenganeensis</i> (Hayata), Tanaka. <i>C. limon</i> , Linn. <i>C. limonia</i> , Osbeck. <i>C. limonia ottensis</i> , Tanaka. <i>C. bergamia</i> , Risso and Poit. <i>C. limetta</i> , Risso.	Mahalung (citron).
4. <i>Shaddock-Intermedia.</i>	<i>C. maxima</i> (Burm.), Merril. <i>C. paradisi</i> , Macf. (grapefruit). <i>C. intermedia</i> , Hort. (nov.). <i>C. kotsukui</i> , Hayata. <i>C. glaberima</i> , Hort. (nov.).	Pomelo (papnas).
5. <i>Sour-Sweet Orange.</i>	<i>C. aurantium</i> , Linn. <i>C. sinensis</i> , Osbeck. <i>C. taiwanica</i> , Tanaka and Shimada. <i>C. tankan</i> , Hayata. <i>C. medioglobosa</i> , Hort. (nov.). <i>C. natsudaidai</i> , Hayata, etc., etc.	Seville or sour orange. Mosambi and Naval oranges.
6. <i>Yuzu-Ichangensis.</i>	<i>C. junos</i> , Sieb. sec. Tanaka.	
7. <i>Loose-skin Oranges.</i>	<i>C. ickangensis</i> , Swingle.	
(a) <i>Nobilis.</i>	<i>C. nobilis</i> , Lour. <i>C. unshiu</i> , Marc. <i>C. yatsushiro</i> , Hort. (nov.).	Kavla, Ladu and Reshma narangi.
(b) <i>Deliciosa.</i>	<i>C. deliciosa</i> , Ten.	
(i) fruits large.	<i>C. foenensis</i> , Hort. ex Tanaka. <i>C. gengshokan</i> , (Hayata) Hort. <i>C. tangarina</i> , Hort. ex Tanaka, etc., etc.	Santra.
(ii) fruits small.	<i>C. kinokuni</i> , Hort. ex Tanaka. <i>C. ponki</i> , (Hayata) Hort. (nov), etc., etc. <i>C. suntara</i> , Hort. <i>C. keonla</i> , Hort.	
(c) <i>Mitis.</i>	<i>C. mitis</i> , Blanco.	China orange (?).

Hume⁴, in his book "The Cultivation of Citrus Fruits" (1926), discusses some of the most important considerations which have made the standard classification of citrus fruits most complicated. He states that the various distinct types of citrus ought to be

recognised as different species. This suggestion, Hume says, is followed by Swingle,⁵ and therefore he accepts Swingle's scheme of classification in his work. Swingle has raised the Trifoliate orange group and the kumquats to the status of new independent

genera, *Poncirus* and *Fortunella* respectively, as they differ in many essential characters from the other species of citrus. The following table shows in short the

scheme of classification of citrus types offered by Swingle, as also how the Bombay varieties of citrus may best be accommodated in it.

TABLE NO. 4.

Swingle's Classification and the Bombay Varieties of Citrus.

Species of Citrus according to Swingle	Synonyms	English Names	Bombay Varieties
1. <i>Citrus medica</i> , Linn. var. <i>sarcodactylis</i> , Swingle		Citron. Fingered citron.	Mahalung.
2. <i>C. limonia</i> , Osbeck.	<i>C. medica</i> , var. <i>limonum</i> , Linn. <i>C. limonium</i> , Riss.	Lemons.	Jamburi & Id limbu.
3. <i>C. aurantifolia</i> , Swingle.	<i>Limonia aurantifolia</i> , Christman. <i>C. limetta</i> , Auct.	Limes.	Kagdi and Godhadi limbu. Sakhar limbu.
4. <i>C. grandis</i> , Osbeck.	<i>C. aurantium</i> , var. <i>grandis</i> , Linn. <i>C. decumana</i> , Linn.	Pummelo, grape fruit, shaddock.	Papnas.
5. <i>C. aurantium</i> , Linn.	<i>C. vulgaris</i> , Riss. <i>C. bigaradia</i> , Riss. <i>C. aurantium</i> , var. <i>bigaradia</i> , Hook.	Sour or Seville orange.	
6. <i>C. sinensis</i> , Osbeck.	<i>C. aurantium</i> , var. <i>sinensis</i> , Linn. <i>C. aurantium</i> Lour.	Sweet oranges.	Mosambi, Malt and Naval oranges.
7. <i>C. nobilis</i> , Lour. var. <i>deliciosa</i> , Swingle. var. <i>unshiu</i> , Swingle.	<i>C. deliciosa</i> , Tenore. <i>C. nobilis</i> , subsp. <i>genuina</i> , var. <i>unshiu</i> , Makino.	King orange. Mandarins. Satsuma.	Kavia, Ladu, Reshmi. Santra.
8. <i>C. mitis</i> , Blanco.			
9. <i>C. ichangensis</i> , Swingle.			

DISCUSSION.

In the light of the foregoing study, it may be stated that the scheme of classification offered by Swingle⁶ has gone a long way towards solving this complicated problem. The principle involved in this scheme accepts the separation of differing types into species. Swingle's list of citrus species will gain in number with the advance of knowledge, as Tanaka⁷ has remarked. With this modification, therefore, it may not be unreasonable to believe that in due course of time, the foundation laid down by Swingle will be greatly strengthened, and the super-structure of a standard classifi-

cation of citrus fruits will be materially constructed on it.

It becomes now essential to assign to the Bombay varieties of citrus the positions they deserve in the general classification of citrus fruits. In doing so, the writers propose to abide by the scheme offered by Swingle with Tanaka's modification to add more species to it.

The oranges of Bombay fall into two distinct groups, namely, the close-skinned oranges, and the loose-skinned oranges. They have all been considered till now to belong to a single species. Their common botanical name has been *Citrus aurantium*.⁸

Bonavia¹ differentiates these two groups into *C. aurantium sinense*, Gallesio (the close-skinned oranges), and *C. aurantium sinense*, Rumphius (loose-skinned oranges). But these two groups widely differ in many points, and fortunately, they rightly fall into two separate species according to the scheme of Swingle. The close-skinned Mosambi group of oranges goes under *Citrus sinensis*, Osbeck, and the loose-skinned Santra group goes under *Citrus nobilis*, Lour. There are further what may be called horticultural varieties in these species. *C. sinensis*, Osbeck includes the Mosambi* orange, the naval orange and others. Of these the Mosambi is perhaps a distinct variety and is at present of great economic importance in this Presidency. The writers think that it deserves to be recognised as a separate variety, and may be called *C. sinensis*, var. *mosambi* Hort. The other varieties like the Naval orange and the Malta orange are already recognised as such.

The *Citrus nobilis*, Lour. group has no less than four different types grown in this Presidency. They are the Santra, the Kavla, the Ladu, and the Reshmi narangi. The Santra is perhaps the best of the loose-skinned types of oranges. Tanaka⁷ appreciates it as unequalled in quality and names it *Citrus poonensis*, Hort. ex Tanaka. It is therefore already accepted as a distinct horticultural variety. The other types are inferior to the Santra orange. They are also different from one another and may be considered as separate horticultural varieties. They may be then named *C. nobilis* var. *kavla* Hort., *C. nobilis* var. *Ladu* Hort., and *C. nobilis* var. *reshmi narangi* Hort.

Then come the citron, the lemons, and the limes. They were all till now considered here as only varieties of *Citrus medica* according to Linnius. In the new scheme of Swingle they fall into three separate species—*C. medica*, Linn. (citron); *C. limonia*, Osbeck (lemon), and *Citrus aurantifolia*,

* Mosambi is a corruption of Mozambique, from where this variety must have been brought to India.

Swingle (limes). The fruits of Bombay present at least three types under *C. limonia*, Osbeck; they are Jamburi, Id limbu, and Sakhar limbu. The Jamburi and the Id limbu are sour lemons, while the Sakhar limbu is a sweet lemon. The former may be separated by independent botanical names, *C. limonia*, var. *jamburi* Hort., and *C. limonia* var. *Id limbu* Hort. respectively. The Sakhar limbu or sweet lemon has run till now by the name *C. medica* var. *limeetta*, Linn., of which *C. limeetta*, Risso was only a synonym. As all the lemons fall into one species, according to the scheme of Swingle, *C. limeetta*, Risso will have to sink itself in *C. limonia*, Osbeck. It can, however, retain its identity by being recognised as *C. limonia* var. *limeetta* Hort.

The limes too form a separate species, *C. aurantifolia*, Swingle, and include as varieties of Bombay, the kagdi limbu, the godhadi limbu, and the pat limbu. The godhadi limbu has a somewhat thicker skin than the kagdi limbu. The pat limbu is longish in shape while the others are globose. These varieties also may be considered horticultural varieties, and named accordingly. They will then stand as *C. aurantifolia*, var. *kagdi* Hort., *C. aurantifolia*, var. *godhadi* Hort., and *C. aurantifolia*, var. *pat* Hort.

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The Indian Association for the Cultivation of Science, Calcutta.

THE annual grant of Rs. 20,000 which the Central Government has been awarding to this institution has suffered a cut on account of the financial stringency and the offer of Rs. 18,000 for the next financial year by the Standing Finance Committee of the Assembly was based on the report of the Educational Commissioner with the Government of India who inspected the institution in September last. We have always thought that it is an extremely short-sighted policy to curtail subsidies to research institutions in general and in particular to those whose work has earned for India a distinct position in the world of international science. The inveterate tendency on the part of Governments to measure the value of scientific research in terms of its practical applicability to the administrative affairs is hard to cure and the utilisation of its results for increasing

the material wealth of the Nation, while necessary and important, must be subordinate to the claims of wider knowledge and deeper penetration into the mysteries of Nature. Judged by this standard, the Indian Association for the Cultivation of Science under the inspiring guidance of Sir C. V. Raman has achieved remarkable results and his successor Dr. K. S. Krishnan whose zeal and devotion for scientific research are well known, requires perhaps greater financial encouragement than has hitherto been accorded to the Association. Scientific work should not be made to depend on the financial vicissitudes of Government, for its orderly and uninterrupted progress must be assured of a steady and satisfactory income, without subjecting the grant to be based on "a review of the position and the work of the Association annually".

The 150th Anniversary of the Asiatic Society of Bengal.

ON the 15th January the Asiatic Society of Bengal celebrated the 150th anniversary of its foundation by an afternoon conversazione in the Indian Museum, and a banquet in the evening followed by a special anniversary meeting. The Conversazione was attended by the Mayor of Calcutta and about five hundred ladies and gentlemen, the leading citizens of Calcutta. It took the form of a garden party on the lawn of the Museum and special and most interesting collection of exhibits, consisting of paintings lent by the Academy of Fine Arts, copies of old documents from the Imperial Records Department, mostly of the eighteenth century and some concerning the Asiatic Society, paintings of plants from the Botanical Survey, Javanese and Siamese sculptures from Dr. S. K. Chatterji, chemical and physical processes in action by the University College of Science and Technology, prehistoric and tenth century finds from the Archaeological Survey, fossils, crystals and economic products from the Geological Survey, birds of Bengal from Dr. S. C. Law, diseases, their prevention and treatment, by the School of Tropical Medicine and Hygiene, medals and coins by His Majesty's Mint, Kaffir attire, fish, crustacea and insects from the Zoological Survey.

The Banquet was honoured by the presence of His Excellency Sir John Anderson, Governor of Bengal, who is the Patron of the Society, and took place in its 126 year old hall, surrounded by portraits and busts of former members who have made history in Bengal. Ninety-three members and guests took part, including the Consular representatives of France, Germany, Holland, Sweden and the United States of America, the Archbishop of Calcutta, the Hon. Sir M. N. Roy Chowdhury, Sir David Ezra, the Hon. Nawab K. G. M. Faroqui, Sir C. C. Ghose, the Hon. Sir A. K. Ghuznavi, Lord Sinha, the Hon. Sir B. P. Singh Roy, and Sir Jadu Nath Sircar. The toast of the Guests was proposed by the President, Dr. L. L. Fermor, to which Mons. J. Delacour of the National Museum of Paris replied, and also proposed the Asiatic Society, but speeches were brief in view of the meeting afterwards.

At the Special Anniversary Meeting His Excellency the Governor took the chair and the President delivered his Anniversary Address, outlining the history of the Society and naming the distinguished contributors to its publications, more especially in the last half century. He pointed out that many of the specialist departments and institutions founded in India originated from

the Asiatic Society, in particular the Indian Science Congress, and mentioned the proposals which had been made for the formation of an Indian Academy of Sciences to effect co-ordination between these various interests in the sphere of science.

Following the President's Address, congratulatory messages were read from His Excellency the Viceroy, the Mayor of Calcutta, the League of Nations, Prof. C. Rockwell Lanman, Sir George Grierson, and Sir Thomas H. Holland, Honorary Fellows. Seven addresses were read from the British Museum, the Linnean Society, the Zoological Society of London, the Batavian Society of Arts and Sciences, the Indian Institute, Oxford, the Schopenhauer Society, Frankfurt, and the Prussian Academy of Sciences. Congratulations were presented by 26 delegates from 58 learned institutions, and in all 19 countries were represented,—Australia, Austria, Belgium, Ceylon, Canada, France, Federated Malay

States, Germany, Great Britain, Hungary, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, Tasmania, United States and India.

In his speech His Excellency the Governor stressed the vigour of the Society in spite of its age, its permanence since the days of the French Revolution, and the esteem in which it is held abroad, as manifested by the spontaneous tributes received from all over the world. He drew attention to the traditional connection of the Ruling Princes with the Society, and hoped that this tradition might be widened, to the benefit of scholarship, by the inclusion in the Society's list of members of the name of every substantial Ruler in the country.

His Excellency paid special tribute to three members of the Society, Sir Rajendra-nath Mookerjee, Mr. Johan Van Manen, the General Secretary, and Dr. S. L. Hora, the Honorary Secretary of the Celebration Committee.

Research Notes.

Separation of the Heavy Hydrogen Isotope. IN *Die Naturwissenschaften*, 21, p. 884, 1933, Prof. G. Hertz describes experiments performed by him in collaboration with H. Harmsen and W. Schütze to separate the heavy hydrogen isotope by means of the new separating apparatus developed by him. (A description of this apparatus has already appeared in a previous note in this journal.) Since the two isotopes of hydrogen have masses in the ratio of one to two, separation by diffusion should be easiest in this case. The hydrogen was produced by the action of magnesium vapour on the water in an electrolytic cell. Since this hydrogen contains H_2^1 and H^1H^2 molecules with only a very few H_2^2 molecules, a discharge tube was introduced at a suitable point of the apparatus so that H_2^1 and H_2^2 molecules were produced from the H^1H^2 molecules. In this way the H^2 isotope was obtained in such purity that discharge tubes filled with this gas after fully degassing the electrodes did not show even a trace of the ordinary hydrogen lines. The paper contains two interesting photographs, one giving the H_2^1 line of H^1 and H^2 taken on the same plate and the other giving the many-line spectrum of hydrogen from tubes containing ordinary hydrogen, a mixture of the two.

isotopes in nearly equal proportions and pure heavy hydrogen respectively, all taken on the same plate. In this way one can distinguish between the lines of H_2^1 , H^1H^2 and H_2^2 and the comparison is very instructive. Further details are to appear in the *Zeitschrift für Physik*.

Experiments on the Adiabatic Cooling of Paramagnetic Salts.

IN *Physica* (1, 1, 1933) W. J. de Haas, E. C. Wiersma and H. A. Kramers describe experiments in which extremely low temperatures were sought to be obtained by the sudden demagnetisation of paramagnetic salts kept at the temperature of liquid helium. A sample of the salt was kept surrounded by liquid helium at a point in the field of a big electromagnet where $H \frac{dH}{dx}$ was a maximum. The sample was thermally well isolated and shut off from radiation. It was thus kept in the high constant magnetic field till it had acquired the temperature of the liquid helium. The field was then suddenly decreased and the force on the sample was then determined as a function of the time. Knowing the force immediately after the decrease in the field

and also its value in the same small field at the temperature of liquid helium, the lowest temperature reached could be calculated, assuming the product of susceptibility χ and absolute temperature T to be constant. Because of the assumption of the constancy of χT the estimated temperature is only an upper limit. The specimen thus serves as its own thermometer.

The following table shows the results obtained :—

Date	Salt	Lowest Temperature Reached
6th April	CeF ₃	0°.27 K.
24th May	"	0°.19 K.
15th June	Dy ethyl sulphate	0°.15 K.
7th July	"	0°.12 K.
"	Ce ethyl sulphate	0°.10 ⁵ K.
"	"	0°.08 ⁵ K.

In a note added in proof, the authors report the conclusion of experiments with potassium chromic alum which gave a calculated lowest temperature below 0°.05 K. The authors remark that because of its cheapness, its high moment which leads to saturation even under low fields, and its regular crystalline shape which removes difficulties of orientation, this salt is best suited for experimental production of the lowest temperatures.

Diffraction of Light by Supersonic Waves. R. BÄR (*Helvetica Physica Acta*, 6, 570, 1933).

The diffraction patterns resulting from the diffraction of light by supersonic waves obtained by the method of Debye and Sears (*Proc. Nat. Acad. Sci.*, 18, 409, 1932) are reproduced in the paper. These photographs show that the intensity of the individual diffraction pattern is a function of the order of interference, showing maxima and minima. The position of these maxima and minima is a function of the intensity of the supersonic rays, the value of the ratio of the wavelength of the supersonic waves to that of the light waves, and also of the distance traversed by the light rays through the supersonic waves. Using the method developed by the author and Meyer (*Phys. Zs.*, 34, 393, 1933) for obtaining photographs of supersonic wave fields in liquids, the diffraction of a supersonic wave by a wire grating has been investigated. Photographs are also given showing the reflection and refraction of supersonic waves at the boundary between two liquids, e.g., with p-Xylo above and water below.

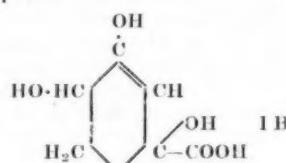
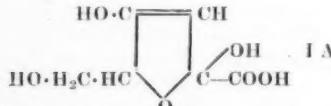
Ascorbic Acid.

SZENT GYÖRGYI isolated from the cortex of the suprarenal capsules, a strongly reducing acid, C₆H₈O₆, which is also widely distributed in plants and animals (*Biochem. J.*, 22, 1387, 1928). This acid answers the colour reactions given by carbohydrates. King and Waugh isolated an identical substance from lemon juice (*J. Biol. Chem.*, 97, 325, 1932). Györgyi's acid was originally named hexuronic acid because it was supposed to be derived from some non-specified hexose in the same way as glycuronic acid is produced by the oxidation of glucose in the animal body. But, later work has shown that it is not a member of the uronic acid group. In view of its strong antiscorbutic activity, Haworth and Györgyi have altered the name to ascorbic acid (*Nature*, 131, 24, 1933).

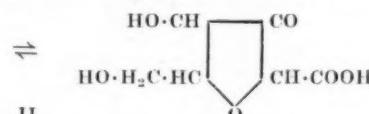
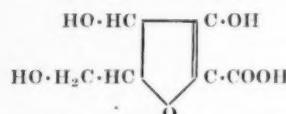
The essentially complete parallelism existing between the antiscorbutic activity and the ascorbic acid content of plant and animal tissues has been pointed out by Harris and his co-workers (*Biochem. J.*, 27, 303, 1933). This acid does not owe its antiscorbutic activity to any contamination with a highly active substance, for the acid liberated from the thoroughly purified mono-acetone derivative, is strictly identical with the original substance and possesses undiminished antiscorbutic activity. Ascorbic acid is now regarded as vitamin C in a pure crystalline form (Szent Györgyi, *Nature*, 131, 225, 1933).

The remarkable chemical property of the acid is its high reducing power. When oxidised by iodine in acid solution, a dehydro acid is formed which is still antiscorbutically active. This acid can be reduced to the original acid by hydrogen sulphide or hydriodic acid. Colour reactions with ferric chloride and sodium nitroprusside are indicative of an enolic group; the presence of a double bond is deduced from its reaction with tetrannitromethane, with which a deep yellow colouration is produced (Karrer, Salomon, Schöpp and Morf., *Helv. Chim. Acta.*, 16, 181, 1933). The presence of a primary alcoholic group is evidenced by the formation of a triphenyl methyl derivative. The formation of a di-p-nitro phenyl hydrazone shows the presence of two carbonyl groups. One of these is adjacent to the carboxyl group, since oxidation with hydrogen peroxide readily yields oxalic acid. On the basis of these observations Karrer,

Schöpp and Schwarzenbach suggested I A and I B as the probable alternative formulae for ascorbic acid (*Helv. Chim. Acta.*, **16**, 302, 1933);

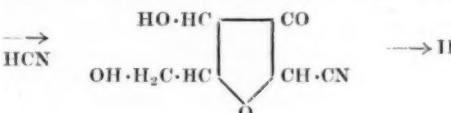
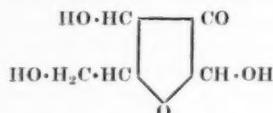


Micheel and Kraft, however, favoured the structure II (*Nature*, 131, 274, 1933);



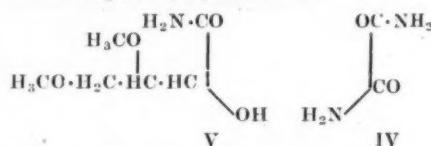
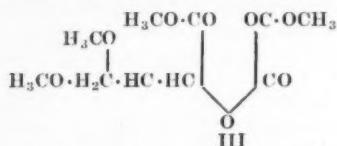
This formula was in harmony with Reichstein, Grüssner and Oppenauer's original interpreta-

tion of their synthesis of the dextro isomer of ascorbic acid (*Helv. Chim. Acta.*, **16**, 561, 1933).

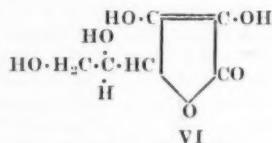


Based on a study of methyl derivatives and other reactions of ascorbic acid, Hirst and his collaborators have arrived at an entirely different structure (*Nature*, **131**, 617, 1933; *J. Chem. Soc.*, **299**, 1270, 1933). Ozonisation of the tetramethyl derivative of ascorbic acid results in the rupture of the

pre-existing double bond and the formation of a neutral product III identified as methyl-3 : 4-dimethyl-1-threonate, substituted in position 2 by a methyl oxalate residue. This product on treatment with methylalcoholic ammonia yielded oxamide IV and 3 : 4-dimethyl-1-threonamide V.

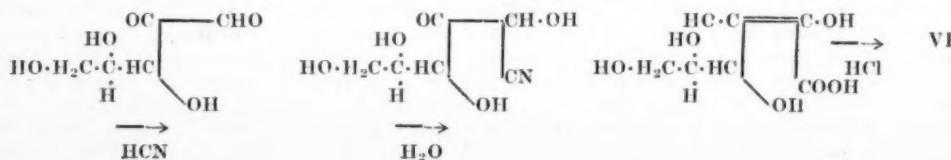


These observations are easily explained by the structure VI given by them to ascorbic acid:



of formaldehyde by the oxidation of dimethyl ascorbic acid with lead tetra-acetate (Micheel and Kraft, *Z. physiol. Chem.*, **218**, 280, 1933). This is also more in harmony with the X-ray data of the crystalline material, which demands an extraordinarily flat molecule (Cox, *Nature*, **130**, 205, 1932).

The synthesis by Reichstein, Grüssner and Oppenauer (*Helv. Chim. Acta*, **16**, 1019, 1933) and Haworth and collaborators (*Jour. Soc. Chem. Ind.*, **52**, 645, 1933; *Jour. Chem. Soc.*, **332**, 1419, 1933) is now explained thus:



The reaction between acetone-dimethyl-ascorbic acid and magnesium methyl iodide gives additional support for the lactone formula (Karrer, Schöpp and Zehnder, *Helv. Chim. Acta.*, **16**, 1161, 1933). The analytical results of the product of reaction agrees closely with those to be anticipated on the basis of VI.

P. R. KRISHNASWAMY.

Blister Rust of Pine.

BLISTER rust is a fungus disease attacking young pine plants causing considerable damage to the healthy regeneration of this valuable species. As in the case of other rusts, the organism belongs to the group of heteroecious fungi which pass their life cycle in more than one host and the inadequate knowledge of the alternate host in the present instance, was responsible for the slow progress on the subject although the fungus (*Peridermium himalayense*) was isolated long ago. The occurrence of rusts on plants which form constant associates of pine acting as the possible alternate stage of this fungus, the identification and description of new organism, its biological relationship to the chir parasite, and the control measures for checking the spread of this pest after elaborate studies, form the subject of a contribution by Dr. K. Bagchee (*The Indian Forest Records, Botany Series*, **18**, Part 11, 1933).

The author discovered in the course of his studies that certain annual plants belonging to the genus *Swertia* were found always associated with pines in the pine stands, and that some species of this genus suffered from a rust disease the most prominent of which was *Swertia alata*. Strangely enough where pine was not diseased, these species also were free from infection. The several sylvicultural observations relating to the occurrence and spread of these diseases are recorded by the author. It occurs from the above that an inter-relationship possibly exists between the pine rust and *Swertia* attack. In fact, a biological inter-relation has been definitely established in this publication between the accidial spores of the *Peridermium* and the *Cronartium* fungus which is the cause of *Swertia* infection. The latter is visible only in a few species of *Swertia* but not in all. This new fungus is named as *Cronartium himalayense*, and its morphological characters are described in the paper at great length.

A variety of inoculation experiments with the accidiospores of the coniferous rust fungus were carried out under controlled conditions on the *Swertia* plants. In a fortnight's time the *Cronartium* stage of infection was actually reproduced on the new hosts. The various conditions, such as humidity, temperatures, the quantity of the inoculum and the age of the inoculated plant for successful infection, have been worked out by the author. The incubation period extends generally from 7 days to 3 weeks for all the hosts examined. This successful transmission gives the direct clue to short distance transference of the disease in nature to the pine plants, through the widely distributed *Swertia* plants acting as alternate hosts to the organism. The long distance dissemination can be assumed to be caused by wind-borne accidiospores. In the field, these spores gain access into the plants through the stomata of the leaves. Thus the infection spreads to the broad-leaved hosts (*Swertia Sp.*) during the early monsoon rains and re-infection of pine takes place through sporidia derived from the germinating teleutospores during the latter part of the monsoon. The several stages of the rust fungus, such as accidiospores, teleutospores, uredospores and sporidia characteristic of such organisms are detailed. The phenomena of over-wintering of the various spore forms does not appear likely. The accidiospores do not over-winter in the pine plants. The alternate hosts, being annuals, do not permit the fungus to over-winter in the uredostage.

Thus the control of these rusts is a problem of supreme importance. The introduction of pines resistant to the disease, derived from foreign localities, is beset with considerable difficulties. Other diseases not known locally should not be imported and the successful generation of those plants should be ensured under new environmental conditions. The indigenous pine species have not yielded encouraging results. Several sylvicultural operations, such as admixture of pine with other species, departmental burning, etc., have proved difficult. The control of the chir rust is easy if one of the hosts can be eradicated. In this case, the alternate host being an annual, seems to be apparently easy to get rid of. The author has suggested a scheme of operations to check the malady by destroying the *Swertia* plants soon after the rains till early autumn. But it is rightly feared that

the same for several reasons may not find favour with the authorities, although a trial will not be a useless proposition. It is suggested here, however, that the increasing application of chemicals for the removal of the annual weeds—Swertia here is actually a weed—is a virgin field for investigation and it is hoped the same may commend itself to the author and to the authorities. It is sure to be cheap, efficacious and simple.

V. I.

The Tongue of *Rana hexadactyla*.

IN an interesting article in the *Records of the Indian Museum* (Vol. 35, part II, 33) C. P. Gnanamuthu describes how exactly the tongue in the frog is brought into action. According to the older authors either the pressure due to the lymph was responsible in exerting the tongue or the muscles, genio-glossus and hyo-glossus acted as protractors and retractors respectively. The present author clearly points out that the hyoid muscles subserve a different function; the two muscles genio- and hyo-glossi are the only ones concerned in governing the movements of the tongue. The muscle hyoglossus remains in a contracted state and is relaxed when the tongue is pushed forward; the dorsal part of m. genioglossus reduces the length and breadth of the tongue while the basal part serves for the pivotal movement of the anterior part of the tongue.

The Thermal History of the Earth.

ARTHUR HOLMES has published a very interesting paper on "The Thermal History of the Earth" in a recent number of the *Jour. Washington Acad. Sci.* (Vol. XXIII, No. 4, 1933). In this paper the physical assumptions involved in the various hypotheses bearing on the earth's thermal history are reviewed, in the light of what is known of the actual behaviour of the earth. The Thermal Contraction Hypothesis of Jeffreys and the Hypothesis of Thermal Cycles of Joly have both been critically examined and found untenable. The hypothesis of Sub-crustal Convection Currents advocated by Bull and Holmes is next considered and is shown to give a reasonable explanation for the distribution of mountains in space and time, for the associated geosynclines and oceanic deeps, and for igneous activity in general.

The New Mineralogy.

IN a recent number of the *American Mineralogist* (Vol. XVIII, No. 3, March 1933) A. N. Winchell has a very important paper on what he calls 'The New Mineralogy'. The author first describes the various ways by which minerals vary in composition and illustrates the relations between these variations and variations in optic properties, giving a new diagram of the diopside-hedenbergite-clinoenstatite system. He states further: "It is only very recently and very gradually becoming apparent that any fixed and definite composition within the limits of variation of any mineral has fixed and definite physical characters. This correlation of physical and chemical properties was impossible in many cases as long as the mineralogist had no key to unlock the door of his crystal palace. Now that he has entered these palaces, he has learned for the first time to understand how they vary in composition; such a knowledge was necessary in order to make it possible to show the relations between physical characters and chemical composition. The aim in the scientific studies of minerals should no longer be merely the name of the mineral but the determination of the precise composition in terms of end-members and for this purpose, accurate measures of optical constants are second in importance only to complete chemical analyses of carefully purified samples."

Carotenoids and Flavines.

IN a paper presented before the Leicester Meeting of the British Association for the advancement of Science, Richard Kuhn has discussed the properties of these important colouring matters. The first products of synthesis in plants are dye-stuffs with 40 carbon atoms, and these undergo oxidative disintegration into carotenoids with fewer carbon atoms. The α , β and γ carotenes are provitamins A. The widely distributed yellow, water-soluble colouring matters fluorescing with green are the flavines. Lactoflavine prepared from milk promotes normal growth in rats deprived of vitamin β_2 . The flavines can be reversibly reduced, and these act as transporters of oxygen in the cell. When combined with carriers of high molecular weight they appear to act as oxidation enzymes. The properties of the carotenoids and flavines appear to be complementary in many respects.

Science News.

Paper from flowering bamboos.—The exhaustive experiments conducted at the Forest Research Institute by Mr. Khaja Nizamuddin, B.Sc. Tech., A.M.C.T. (Manch.), Paper Expert, Commerce and Industries Department, Hyderabad, a description of which is incorporated in a bulletin recently published, clearly show that flowered bamboo even after four years' standing, though dry and dead, retains its paper-making qualities, and can therefore be profitably exploited for paper manufacture. The flowered bamboos are immune to the attack of boring beetles and this is a great point in favour of the utilisation of such bamboos. Severe drought in bamboo forests leads to exhaustive flowering, and the fear that such flowering interrupts the supply of raw materials, has now been dispelled. Samples of papers prepared from flowered bamboos, which have been attached at the end of the pamphlet show their highly satisfactory character, and it is hoped that capitalists would come forward to exploit the scheme for paper manufacture outlined in the bulletin (No. 4) issued by the State Department of Industries and Commerce.

Indian Chemical Society.—The Tenth Annual Meeting was held at Bombay on the 4th January, Dr. Gilbert J. Fowler, D.Sc., F.I.C., presiding. The Secretary's report for the year 1933, and the Treasurer's statement of accounts for the same year were adopted. Dr. J. N. Mukherjee moved a resolution of the Council to the following effect:—“Resolved: (a) That there be only one kind of membership, as regards the eligibility to hold office or to vote, provided that the persons other than in *statute papulaire*, belonging to any branch of the profession of chemistry, who are in receipt of a salary of Rs. 150 a month or less may apply to be exempted from Rs. 10 of the annual subscription and that the Journal and other scientific publications excepting Annual Report and supplementary publications relating to industrial matters will not be supplied to them. (b) That all such cases shall be approved by the Council on the recommendation of the local Branch where it exists. (c) That the Secretary of the Bombay Branch be requested to draft rules with a view to circulate them to the members of the Council for consideration. (d) That rules are to be circulated to other branches.

Sir J. C. Bose was unanimously elected Hon. Fellow of the Society.

The Council's nominations for the publication committee were unanimously accepted. The Committee consists of (1) Dr. S. S. Bhattacharjee, (2) Dr. V. Subrahmanyam, (3) Dr. T. S. Wheeler, (4) Dr. H. K. Sen, (5) Mr. B. Viswanath, (6) Dr. J. N. Ray, (7) Dr. J. C. Ghosh, (8) Dr. A. C. Sircar, (9) Dr. P. Neogi, and (10) Mr. P. Ray.

Mr. P. Ray was elected Hon. Secretary, Dr. P. N. Neogi, Hon. Treasurer and Messrs. P. C. Nandi and T. K. Raychoudhury, Hon. Auditors for the year 1934. The following members were elected to the vacancies in the Council for the different centres. Ordinary Members for *Calcutta*: Dr. U. N. Brahmachari, Dr. R. L. Datta, Dr. Sudhamoy Ghosh, Rev. Father J. Van Neste; *Bombay*: Dr. K. G. Naik; *Bihar & Orissa*: Dr. R. C. Ray; *C. P.*: Dr. A. N. Kappanna;

S. India: Dr. B. B. Dey, Sir M. O. Forster, Dr. S. N. Chakravarthi, Dr. B. L. Manjunath; *U.P.*: Mrs. Sheila Dhar, Dr. S. S. Joshi, Dr. R. F. Hunter; *Punjab*: Dr. H. B. Dunnicliff.

Society of Biological Chemists, India.—The Third Annual Meeting was held at Bombay on the 6th January 1934. The following members have been elected office-bearers for the year 1934:—*President*: Rai Bahadur Dr. Upendranath Brahmachari, M.A., M.D., Ph.D., F.A.S.B. *Vice-President*: Dr. Gilbert J. Fowler, D.Sc., F.I.C. *Members*: Prof. R. H. Dastur, M.Sc., F.L.S. (*Bombay*); Dr. P. E. Lander, M.Sc., D.Sc., I.A.S., F.I.C. (*Lahore*); Dr. J. A. Iswaramurthi, B.A., L.M. & S., B.S.Sc. (*Bangalore*); Mr. C. S. Rama Iyer, B.A. (*Pusa*); Dr. H. K. Sen, D.Sc., D.I.C. (*Calcutta*); Dr. K. C. Sen, D.Sc. (*Mukteswar*); Lt.-Col. J. A. Sinton, V.C., O.B.E., I.M.S. (*Kasauli*); Rao Bahadur B. Viswa Nath, F.I.C. (*Coimbatore*); Dr. M. Damodaran, D.Sc., F.I.C. (*Madras*); and Mr. D. Narayananamurti, M.Sc. A.I.C., A.Inst.P. (*Dehra Dun*). *Secretary*: Mr. B. N. Sastri, M.Sc., A.I.C. *Treasurer*: Dr. V. Subrahmanyam, D.Sc., F.I.C. *Hon. Auditors*: Dr. B. T. Narayanan, Ph.D., and Mr. B. N. Banerjee, M.Sc.

It was resolved that (1) the members of the Society convey their best thanks to Rai Bahadur Dr. Upendranath Brahmachari, M.D., etc., for the donation of Rs. 100 made to the Society and for his generous assurance to give annually a donation of Rs. 100 for the next four years; (2) the members of the Society convey their best thanks to the Council of the Indian Institute of Science, Bangalore, for the generous grant of Rs. 200 to the Society.

Institute of Chemistry of Great Britain and Ireland.—At a meeting of the Associates and Fellows held during the Science Congress Week at Bombay, it was resolved to start an Indian Branch of the Institute of Chemists with the following objects:—

(1) To establish helpful relations among all Members of the Institute resident in India.

(2) To enable local meetings of social and technical character to be held as occasion arises, either of the Members of the Institute independently or in co-operation with other scientific bodies in the neighbourhood.

(3) To hold an annual meeting of the Indian Section on the occasion of the Indian Science Congress at which matters affecting the interests of the Members of the Institute may be discussed.

A strong committee was appointed to work out the details with Mr. G. W. Douglas, Director of Agriculture and State Chemist, Bhopal, as Secretary.

Archaeological Discovery in Delhi.—Khan Bahadur Maulvi Zafar Hasan, Deputy Director-General of the Archaeological Survey of India, has recently discovered the long-lost site of the Hall of a Thousand Pillars (*Kasr-i-Hazar Satun*) one of the glories of medieval Delhi, among the ruins of Siri, the second of the Seven Cities, a quarter of a mile off the Qutub Road. Careful comparison of the position of the large mounds which were observed in the ruined city of Siri, in relation to

other buildings that have already been identified, and the study of the ancient documents have confirmed the view that the mounds had covered the royal palaces of the Great Allauddin Khilji. This great Hall when fully excavated will form a notable addition to the Khilji remains in Delhi. It may be recalled that about the year 1550, Sher Shah destroyed Siri, the city founded by Allauddin Khilji in 1303. The famous Hall of a Thousand Pillars which was used as a Royal Palace, was also demolished by Sher Shah who used the materials of the destroyed city for constructing a new town of which the famous *Purana Qila* was the citadel.

* * *

Biological Control of Epidemic Diseases in Mysore.—Remarkable results have been obtained by the Health authorities in Mysore in the control of Malaria, small-pox and other diseases by employing larvicidal fishes like Italian *gambusia* which have been systematically popularised. These results were recently demonstrated before Doctor Paul F. Russell of the Field Staff of the International Health Division, Dr. Victor G. Heiser, Associate Director, Rockefeller Foundation, Dr. John Fitzgerald, Director of the University of Toronto, Prof. W. W. Jameson, Dean of the London School of Hygiene and Tropical Medicine and Dr. Jacocks (Colombo) who are visiting the Health Centres in India, to study the various problems of public health in which the Rockefeller Foundation is interested and gain some first-hand knowledge of medical work in India. The visitors were impressed with the results of the Mysore experiments which have attained unique records in Health Control.

* * *

Possibilities of Fruit Canning in India.—Under the auspices of the Society of Biological Chemists, India, Dr. D. V. Karmarkar, M.Sc., Ph.D., delivered a very interesting address on "Fruit Canning" on Tuesday, the 30th January 1934 in the Biochemistry Lecture Hall, Indian Institute of Science. In the course of his address the lecturer said, "The Canning Industry in the United Kingdom is at present in a thriving condition but it will have its limitations as the supply of fruit is sure to become the determining factor. In these days of Empire Preference, therefore, I do not see why India should not have a trial at this industry. England as at present will continue to remain the biggest buyer of canned fruits. Australia, South Africa, Malay States and other parts of the Empire have already established this industry and, in my opinion, it is high time that India also makes a start."

"India is at present doing very little in this direction. It is possible to utilise the Indian tin plate for the manufacture of suitable cans. The different sugar factories helped by the sugar research stations recently started promise us a good and cheap supply of sugar. India claims to grow different kinds of fruits in plenty and if necessary, can grow more of them. There is no want of highly skilled research workers. What we need at present is a start in the right direction and proper organisation for creating a market at home and abroad."

* * *

Research in 1933.—Under the title "A Rip Van Winkle View of Ethics in 1933" (*The Chemical Age*, 29, 589, 1933), Prof. H. E. Armstrong has

expressed in his characteristic way his views on modern chemical research. The following extracts reproduced from the Professor's article may prove interesting to readers of *Current Science* :—

"The world, to-day, is a world of scientific discovery of overwhelming importance; unfortunately, it is also predominantly, a world of advertisements to serve commercial ends. The condition I deplored 15 years ago has now grown intolerable. Scientific workers are openly serving two masters; they almost glory in riding with the hounds while running with the hare. Not only is the world, in general, in the throes of a merciless civil war of commercial competition; equally in the scientific world, ruthless civil war rages between individual workers. Each one for himself, the devil take the hindmost, is the prevailing doctrine in the struggle for place and purse; perhaps also to satisfy the artists' craving for praise and applause. No sooner is an idea started than harpies from everywhere pounce upon it.

"Last year, there was a competitive international rush to secure the rights of vitamin D, in which our state laboratory, under the direction of the Medical Research Council, won by a short neck: a six-man team was engaged upon the work. This year the appointed work of the Birmingham University laboratory has been interrupted, in order to solve a similar sensational problem, in connection with the supposed vitamin C; on this a whole crowd was engaged. Who held whose hand, who washed out which test tube, is not stated. When the expected prize is allotted, how is it to be apportioned? Will each of the workers be presented with a framed certificate (See *R. Soc. Arts Journal*, Dec. 8, p. 109) and a penny whistle, so adjusted that, when he proceeds to blow his trumpet, the squeak will be of proportionate loudness? Obviously the race was against time for priority. What must be the moral effect upon students of such methods of working, of such training?

"Four-fifths of the work that is published in the Journals may be set down as of slight account: no one considers it; it is too unfinished or too trivial in subject. We have in some way to collect the few grains of gold and scrap the rest. Titles must be shortened and made rational, many are too absurd. 'Scaffold Poles and Mortar Moments'—to a floppy mass of Mortar flung about without rhyme or reason, to no obvious end. The label 'Parts I to infinity' is meaningless attached to accounts which should never have had a beginning.

"All said and done, however, there is some gold to be found that glitters. Wisdom is coming from the plant and is passed on to ourselves. A mighty future may well be in store for chemistry. If worthily pursued, it may well be called upon to take charge of public well-being. We know that we ourselves live wholly bedrugged lives. Now we are learning that the plant is equally controlled—that cell growth in the young plantlet takes place under the influence of a definite growth agent termed auxin. Although this is present in most minute proportions, it has been isolated in the crystalline state. The composition of Auxin is $C_{18}H_{32}O_5$. The story is a veritable romance. The discovery is the work of the combined physiological and chemical forces of the Utrecht School, under Professors Went and Kogl. The proof is simple. When the tip of the young oat seedling

(the coleoptile) is cut off, the shoot ceases to grow ; growth re-commences when it is restored or even if the cut-off tip be placed, for a time, on a fragment of agar jelly and this fragment alone is placed upon the cut surface of the shoot. The agent is thus shown to be soluble. The amount present is perhaps one part in half a million of the plant material.

"Equally remarkable is the discovery in milk of *Lactoflavin*, referred to in *The Chemical Age* of December 16. Assuming this to be correctly represented as the B_2 adavitant, the isolation of the substance from milk is of the greatest importance. There has been no public beating of drums over either discovery and no general rush to do work of this character is noticeable. Yet it is the work of the future, for which real chemists must be specially and fully trained. The outstanding task of difficulty will be the precise determination, by competent chemists and physiologists working in unison, and animal activity effect their distinctive purposes. Chemistry may be said to be full of vitality, because its outlook is becoming increasingly vital : in this special connection, of ever-growing public importance."

Damage caused to the Cotton Crop by White Fly.—The life history of the white insect which causes considerable damage to the cotton crop has been recently worked out by the entomological section of the Punjab Agricultural Department (*Indian Trade Journal*, Jan. 4, 1934). It has been observed that the attack on the early sown crop is greater than on the late crop. The pest is met with all the year round and the duration of the life cycle of the fly is about 18 days during the warm months, April to October; it extends over 107 days during the other months. As a result of the attack the reproductive activity of the cotton plant is interfered with. The bud and boll formation is indirectly proportional while the bud and boll shedding is directly proportional to the intensity of the white fly attack. Further the infested plants produce a less number of seeds per boll and a lower lint percentage than those kept free from infestation. As control measures, application of nitrogenous fertilisers and increased number of irrigations are recommended. Spraying with rosin compound in the ratio of 1 : 6 has given very encouraging results both with regard to the mortality of the pest and the subsequent yield.

The Hilger Vitameter-A.—Adam Hilger, Ltd., 98, King's Road, Camden Road, London, N. W. 1, England. (Hilger Publication No. 191/2.)

This booklet describes a new means of testing the Vitamin A chromogen content of cod and other fish liver oils, a most important matter in the successful medical application of these substances.

The apparatus (for which patents have been applied in Great Britain and abroad) measures the absorption of the solution for radiations in the immediate neighbourhood of 3280 \AA and is based on the spectrophotometric method of test. Measurements are made visually by comparing the intensity of two fluorescent areas and rendering them equal by a photometric device whose scale gives readings that are a direct measure of the Vitamin A chromogen content.

The makers claim that the method is more con-

venient and better suited to use by comparatively unskilled operators than those hitherto adopted.

The possibility of the use of this apparatus at all stages of the processes of extraction, refining, blending and distribution, even by comparatively unskilled labour, should render it of great interest in the associated industries.

Asiatic Society of Bengal.—At the annual meeting of the Society held on 5th instant, Mr. Johan Van Manen, the Secretary, presented the annual report. The membership at the close of the year stood at 436. During the year under report the Society received numerous valuable Persian, Arabic and Hebrew Manuscripts from Mr. Hafeez Abdul Gafur and Sir David Ezra. In spite of the fall in the income due to economic depression, the Council have decided to continue their programme of publication during the next year for which adequate provision has been made in the budget and it is hoped that the arrears into which the Society's Journal has fallen, will be made good in the coming year.

Dr. L. L. Fermor who presided on the occasion read a message from His Excellency the Governor of Bengal and announced the biennial award of Barclay Memorial Medal to Dr. R. Row of Bombay for research in Medical and Biological Sciences and the triennial Anandale Memorial Medal for Anthropological research to Dr. Eugene Dubois.

Dr. L. L. Fermor was re-elected President of the Society, and Mr. Johan Van Manen continues as General Secretary.

One of the most interesting events of the meeting was the election of Mr. D. N. Wadia as a Fellow of the Society and this brings the roll of Fellows to its full complement of fifty. Practically the saturation point has been reached since the institution of Fellowship in 1910. Mr. Wadia occupies the foremost rank among the Indian Geologists and the honour conferred upon him is a fitting recognition of his eminent position as a researcher. His numerous friends will feel gratified and we ourselves offer him our heartiest congratulations. Mr. D. N. Wadia is a Scientist and one of the finest types of gentlemen whom we know and esteem.

Fellow of the Chemical Society.—Sir Profulla Chandra Ray is one of the distinguished chemists who was recently elected Honorary Fellow of the Chemical Society.

Andhra University.—At a recent meeting of the Syndicate of the Andhra University held at Waltair, it is understood that the question of extending the jurisdiction of the Andhra University to the Ceded Districts was considered and the view expressed by the Syndicate was, that Anantapur was to be, in that event, one of the chief centres of University activity.

Life after Death.—Dr. William Brown who is Wilde Reader in Mental Philosophy at Oxford University, in a recent address before the Survival League at Caxton Hall, expressed the view that Science admitted a possibility on the question of whether the soul or spirit of man survives after the death of his body. While the evidence offered by such phenomena as mediumistic trances is very unreliable from the scientific standpoint, it is not impossible that psychological inquiry will yield results that would admit of the possibility of a

survival of the spirit after the death of the body. While the question is claimed to be religious and philosophical, the results of psychical research would certainly add to our knowledge of this question.

Man's Minimum Diet.—The controversy that is now raging between the Ministry of Health and the British Medical Association representatives of the Public Assistance Committee in England over the question of the minimum diet that is necessary for a man is worthy of attention. Regarding the question of the minimum quantity of food that is to be provided for an unemployed adult to keep him in health and working capacity, the special committee appointed by the British Medical Association after very careful examination, came to the conclusion that the minimum diet was to be 3400 calories and 54 grammes of first class protein. Another committee appointed by the Ministry of Health prescribed a lower figure, i.e., 3000 calories and 37 grammes of protein. This has led to a controversy wherein the advisory committee of the Ministry of Health has come in for a lot of criticism.

The point at issue is one which is more scientific than political and while probably the lower figure is enough to sustain the individual, no reserve energy could be guaranteed in case of sickness and no wastage could be permitted. And it is also interesting to note that in peace time the soldier gets a ration of 62.7 grammes of first class protein.

But one is led to think that with all the meagre diet that the Government have prescribed for the unemployed, England's destitutes are very much happier than those anywhere else in the world. India, where the unemployment figures are most appallingly high and where the State does not come to the aid of the unemployed, it is hard to think where we come in the classification of Men.

* * *

Dr. V. G. Deshpande, College of Agriculture, Poona, writing on the "Out-break of Millipedes," says that Millipedes are known to be vegetable feeders and are always found in the fields and gardens especially in wet places among plants and in decaying vegetable matter. Until the year 1932 at least in this part of India they were never reported to have done any damage to cultivated crops. In that year in the month of July at Jalgaon Farm, East Khandesh, the young seedlings of jowar, tur, and groundnut were destroyed by these millipedes all of a sudden appearing in enormous numbers. The damage was considerable, so much so, that the jowar crop had to be resown. In the year 1933 exactly in the month of July on the same farm the appearance of these millipedes was noticed, but the damage was not much in jowar crop. The reason was that there was a break in the rains for about a fortnight and three repeated inter-culturings, which were necessary for the crop to enable it to hold out without

rains, checked them, whereas, last year the conditions were different on account of the wet season. However, in the Cotton Breeder's area the out-break was very serious. The Cotton Breeder reported that the damage done to cotton plants in the pedigree culture (where every plant had its value) would have been enormous were it not for the severe campaign that was set up against these animals. The enormity of the numbers can be judged from the fact that no less than two millions of these animals could be hand-picked and destroyed from an area of two acres only within the course of four days. The amount of money spent for the collection was about 50 rupees besides the use of a tin of kerosene oil for destroying them. These millipedes have been identified by Professor Silvestri of Portici, Italy, as a species of *Spirostreptus* allied to *Sp. modestus*.

* * *

We acknowledge with thanks the receipt of the following :-

- "Nature," Vol. 132, Nos. 3346 to 3349.
- "The Chemical Age," Vol. 20, Nos. 755 to 758.
- "The Journal of Chemical Physics," Vol. 1, No. 12.
- "Berichte Der Deutschen Chemischen Gesellschaft," 66 Jahrg, No. 9.
- "Natural History," Vol. 34, No. 1.
- "Journal de Chimie Physique," Tome 30, No. 9.
- "The Review of Scientific Instruments," Vol. 4, No. 12.
- "Scientific Indian," Vol. 10, No. 60.
- "Indian Forester," Vol. 60, No. 1.
- "Forschungen Und Fortschritte," Jahrgang 10, Nos. 1 and 2.
- "Supplement 56th to the Bulletin of Applied Botany of Genetics and Plant Breeding of the Lenin Academy of Agricultural Sciences in U.S.S.R.
- "The Indian Trade Journal," Vol. CXI, Nos. 1437 to 1440.
- "Monthly Statistics of the Production of certain selected Industries of India," Aug. and Sep. 1933.
- "Forest Research in India, 1932-33," Part II.
- "Canadian Journal of Research," Vol. 9, Nos. 5. and 6.
- "Journal of Agricultural Research," Vol. 47, No. 9.
- "American Journal of Botany," Vol. 20, No. 10.
- "Science Progress," Vol. 28, No. 111.
- "Contributions from Boyce Thompson Institute," Vol. 5, No. 4.
- "Journal of Agriculture and Livestock in India," Vol. 3, Part 6.
- "The Indian Journal of Veterinary Science and Animal Husbandry," Vol. III, Part 4.

Reviews.

ADVENTURES OF IDEAS. By A. N. Whitehead, F.R.S., F.B.A. (Cambridge University Press, 1933.) Price 12s. 6d. net.

At a time when systems of philosophy are not quite in fashion, two great thinkers have had the courage to formulate closely reasoned and well-knit systems of metaphysics, Alexander and Whitehead. Both of them are not only well versed in scientific thought but possess a broad culture which makes their writings somewhat interesting even to the inexpert. Of the two, however, Whitehead is more difficult to follow. He expounds his metaphysical views in a series of works, the chief of them being *Science and the Modern World*, *Process and Reality*, and the present one. The thesis of the present work is thus stated by the author:

"The book is in fact a study of the concept of civilisation, and an endeavour to understand how it is that civilised beings arise. One point, emphasised throughout, is the importance of Adventure for the promotion and preservation of civilisation" (p. vii).

In the first part of the book, some of the great ideas which have moulded our civilisation, such as the essential rights of human beings, freedom and equality, tolerance are traced to their origin and their slow issue into practical results developed. The growth of civilisation is said to be the victory of persuasion over force. The divine element in the world is for Plato a persuasive spirit rather than a coercive agent.

In the second part, Whitehead turns to the discussion of the influence of scientific ideas and the more general cosmological notions on European culture. Taking up the conception of a law of nature, he discusses the four views of the law as immanent, as imposed, as the observed order of succession or mere description and conventional interpretation and draws out the metaphysical implications. In Whitehead's view, science and philosophy are closely bound up. They are different aspects of the one great enterprise of the human mind. They are both concerned with the understanding of individual facts as illustrations of general principles (p. 179). He defines speculative philosophy as "the endeavour to frame a coherent, logical, necessary system of general ideas in terms of which every element of our experience can be interpreted" (p. 285). Whitehead's

whole endeavour is to frame a system of thought which conforms to these canons. We are to-day suffering from the lack of a co-ordinating philosophy of life and it is a pleasure to know that Whitehead's scheme insists on those fundamental beliefs in values which are the only sure stay of the human race.

For Whitehead, as for Plato, God is love more than power. The Dean of St. Paul's in his book on *God and the Astronomers* omits all reference to Whitehead on the ground that he is obscure. Whitehead is undoubtedly difficult and it is unfortunate that Dean Inge has ignored him, for the Dean's views are akin to Whitehead's on religion, for both believe that the greatness of Christianity lies in its illustration of the Platonic truth: "The power of Christianity lies in its revelation in act, of that which Plato divined in theory" (p. 214).

Indian readers will find Whitehead's reference to Gandhi-Irwin truce quite interesting. It is given as an illustration of the practical effectiveness of the religious spirit:

"The other side is that the religious spirit as an effective element in the affairs of men has just (April 1931) obtained one of its most signal triumphs. In India the forces of violence and strife, between rulers and people, between races, between religions, between social grades—forces threatening to overwhelm with violence hundreds of millions of mankind—these forces have for the moment been halted by two men acting with the moral authority of religious conviction, the Mahatma Gandhi and the Viceroy of India (Lord Irwin)."

Part III develops further the views set forth in *Process and Reality* and we see the same logical rigour and metaphysical power which were such characteristic features of the earlier work.

The concluding part deals with those five great qualities of Truth, Beauty, Adventure, Art and Peace, which every society should try to incorporate if it is to be truly civilised. While it is difficult to follow the arguments of this great book, it is not necessary to do so to feel the presence behind it of a refined soul attuned to the highest issues. One noble passage about peace *sānti* may conclude this notice:

"It is a broadening of feeling due to the emergence of some deep metaphysical insight

unverbalised and yet momentous in its co-ordination of values. Its first effect is the removal of the stress of acquisitive feeling arising from the soul's pre-occupation with itself. Thus Peace carries with it a surpassing of personality. There is an inversion of relative values. It is primarily a trust in the efficacy of Beauty. It is a sense that fineness of achievement is as it were a key unlocking treasures that the narrow nature of things would keep remote. There is thus involved a grasp of infinitude, an appeal beyond boundaries."

S. R.

* * *

CATALYTIC OXIDATION OF ORGANIC COMPOUNDS IN THE VAPOUR PHASE. By L. F. Marek and Dorothy A. Hahn. American Chemical Society Monograph No. 61. Pp. 486, 60 figs. (The Chemical Catalog Company, New York.) Price \$ 9.00.

This volume provides a surprise for the reader who expects to find an account of the preparation of formaldehyde, phthalic anhydride and other compounds made by catalytic oxidation. It is true these are not omitted, in fact a whole chapter is devoted to each, but the authors have taken the word 'oxidation' in its widest sense so that information is given regarding the hydration of ethylene, the formation of acetylene and diphenyl, and the production of hydrogen from methane, while no less than 62 pages are devoted to the subject of knocking in internal combustion engines.

In the general introduction it is stated that the primary purpose of these monographs is to present certain topics in a readable form; in this purpose the authors can scarcely be said to have succeeded except by those who take pleasure in reading a dictionary. The secondary purpose is to present a well-digested survey. This certainly has been effected, for the book contains a mass of information which is bound to be of value to students in this field; indeed there is so much information that it leaves the reader with a feeling of confusion rather than with a clear view of what has been accomplished. In the preface the authors disarm criticism of their extensive references to patent literature which they admit to be unreliable, by mentioning the scarcity of other sources of information but this does not exonerate them from the duty of sorting out this literature and presenting only those portions which in their opinion appear significant. Of what value to the reader

for example is the following? (p. 370) "On a patent (for the production of phenol from benzene) has to do with the action of ozone at 390°C. in the presence of an oxygen-occluding substance such as platinum black or platinised asbestos. Pressure is said to exert an important influence and an appropriate form of apparatus is specified and illustrated. This patent is rather broad in its scope and contains fourteen claims covering the oxidation of turpentine and other substances as well." In several cases the long lists of possible catalysts so familiar in the patent literature are quoted *in extenso*. The result is that the really valuable information is buried by unnecessary detail and can only be extracted with considerable difficulty. A great improvement would be effected if only the most important patents were mentioned in the text and the rest consigned to a bibliography with a short abstract of the contents of each. The book contains other unnecessary matter which might well be omitted, for example, table XIX showing the solubility of CO₂ in water and also the description of coal tar and the preparation of naphthalene. It could also do with a great deal of rearrangement; at present it resembles a compilation of library notes under different headings. The action of silver catalysts in the formation of formaldehyde is referred to in two different portions of the chapter; a chain reaction is discussed on p. 211, while on p. 311 under a special heading, chain reactions are explained *ab initio*. The Arrhenius equation is discussed here in almost the same words as on p. 287.

The chapter on 'apparatus' might well be enlarged. At present it bears an air of unreality, the illustrations being merely diagrammatic and conveying little notion of the plant in actual use.

Two misprints, "firebrick" on p. 143 and "Bones" on p. 159 have been noticed, while "to react the formaldehyde with . . ." and similar expressions jar upon the senses of an English reader; otherwise the book is well and clearly printed as is to be expected in this series.

In spite of these defects it is evident that the authors have taken great pains to amass the material they have presented and the volume forms a most valuable contribution to the literature of the subject. If it could be rearranged and reduced to half its present size it would be even more valuable.

H. E. WATSON.

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CHEMICAL CALCULATIONS: Their Theory and Practice. By A. King, M.Sc., A.R.C.S., D.I.C., and J. S. Anderson, Ph.D., A.R.C.S., D.I.C., both of the Chemistry Department, Imperial College of Science and Technology, London. Pp. x + 181. (Publishers: Messrs. Thomas Murby & Co., London, 1933.) Price 4s. 6d. net.

This book is designed to provide the material necessary for "the acquisition of a reasonable facility in chemical calculations". The elementary laws and theories on which the calculations are based are explained with several references to original work. The brief descriptions of some of the original experiments help the young student to quickly grasp the fundamental chemical principles on which they are based. The matter treated in Chapter VI "Volumetric Analysis" would have been better placed if it had preceded the chapter on Electrolysis and Ionic Theory. The Chapters I to IV and portions of VI cover the syllabus of the Intermediate Science Examinations of Indian Universities and the rest may be recommended for the under-graduate students preparing for pass course in Indian Universities. A novel and beneficial feature adopted in this book is to provide answers only for alternate problems. The book will serve as a very useful guide for students.

H. S. J.

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THERAPEUTIC AGENTS OF THE QUINOLINE GROUP. By W. F. Von Oettingen. (Chemical Catalog Co., New York. Pp. 301.) Price \$ 6.00.

Ever since quinine was recognised as the active principle of cinchona alkaloids and Gerhard demonstrated in 1842 that it contained a quinoline nucleus, the quinoline group of organic compounds have attracted great attention of chemists all over the world in an attempt to substitute quinine by a synthetic drug of equal efficiency against malaria. The efforts in this direction have been generally based on the modern chemo-therapeutic principles whose applications in spite of their limitations have revolutionised modern medicine.

It is a matter of surprise and disappointment that in spite of a number of important discoveries of drugs through the brilliant applications of these principles within the last half century, the search for a satisfactory quinine substitute has still remained an evasive problem. The attempts have however furnished a series of compounds whose

physiological activities are more powerful than those of most other known compounds.

The discovery of compounds like Plasmoquine and Atebrine though not entirely as substitutes of quinine but as important auxiliaries in the treatment of different types of malaria, are of prime importance, which suggest that we may not despair of the possibility of evolving a satisfactory remedy as a quinine substitute entirely.

Again, the study of hydrocupreine and acridine derivatives have yielded interesting results.

The difficulties of progress in this field, while partly due to the inherent complexity of the subject, have been enhanced considerably by a certain looseness of thought and even of experimental technique found widely amongst the investigators. So much so that it is only recently we could say that we have accumulated some information which we may worthily designate as "knowledge".

We have to come to a stage in the investigation of the quinoline compounds when we can with some justification attempt to correlate pharmacological action with their chemical structure. There have been several books following Frankle's "Arzneimittel Synthese" to bring out the relation between chemical constitution and pharmacological action. But a special book on this most important group of organic compounds is a welcome addition. Von Oettingen's book has not appeared too early. The American Chemical Society has done a service to the workers in this field by presenting them with a volume of this nature.

The literature has been brought to our knowledge almost quite up-to-date of publication and includes the most important compounds of therapeutic interest. There are many records to be confirmed, sifted and many gaps to be filled before a number of observations could be evolved into principles of definite value. As the author finally remarks, "it is not infrequently that the physiological problems are attacked by methods which appear to be extremely unphysiologic so that only distorted pictures are observed which may lead to misleading conclusions." This book, we hope, will serve to point out the defects to be remedied, the gaps to be filled and the problems to be solved by more systematic research, and closer co-operation between the pharmacologist and the organic chemist.

This is an American Chemical Society

monograph published by the Chemical Catalogue Co., Inc., and in uniformity with other publications of this series the get-up of the book is excellent. It should find a place in the library of the organic chemist and of the pharmacologist interested in this line.

B. H. K.

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RECENT ADVANCES IN PLANT PHYSIOLOGY.
By E. C. Barton-Wright. (J. A. Churchill, 1933.) Price 12s. 6d.

The long-felt need of a text-book in Plant Physiology embodying the recent work done in the different aspects of plant metabolism is being gradually supplied by the English, American and Russian physiologists. The book under review is a notable attempt to give in a brief space of about 300 pages the summary of the most important aspects of plant physiology. The first edition of this book was published in 1929 and the necessity of issuing the second edition within a period of five years indicates that the book is well received and meets the needs of the students. The second edition of the book shows many improvements and there are many additions and alterations in the subject-matter. The chapter on soils is omitted and a few pages on transpiration of xerophytes is added to the chapter on transpiration. Similar alterations and additions are also made in the chapters on translocation, growth, protein synthesis and respiration. In spite of the numerous changes introduced the principal defects of the first edition are unfortunately not remedied. Firstly, the book still remains unbalanced in the arrangements of the essential materials. Too much emphasis and space are given to certain aspects while other equally important ones are either mentioned briefly or left out of consideration altogether. Secondly, too much prominence is given to the work of English authors. Perhaps the second defect is visible in every text-book written by other writers but in this particular one it is more apparent than in the others. It was expected that the chapter on carbon assimilation would be rewritten giving more readable and coherent account of the whole process; but the writer has not yet seen the necessity of doing it in view of the existing monographs on the subject. One feels that this is no valid reason for not doing it in a text-book principally meant for students. There are many passages which could either be condensed or entirely deleted and the place for other important literature can thus be found.

Apart from these defects and drawbacks the book on the whole makes an indispensable text for students and a valuable guide for teachers as well, as the subject-matter is up-to-date and well presented in many places. Many of the intricate and complex data are very lucidly and intelligibly stated and that perhaps explains the great success that the book has achieved. It is earnestly hoped that when the third edition of the book is to be printed some of the points raised in the review will be considered by the author.

* * *

PLANT ECOLOGY. By William Leach, D.Sc. (Methuen & Co., Ltd., London, pp. vi + 104.) Price 3s. 6d.

Books on Plant Ecology are rather limited. Therefore the present volume, forming one in the series of Methuen's monographs on biological subjects, is a welcome addition for those who are interested in vegetation. The book is designed to give a clear and understandable account of the home life of plants. Plant Ecology does not consist in the mere identification and enumeration of the several plant species in a plant community, but in studying the physiology of the species as influenced by several habitat factors. Thus plant ecology is the science of plant physiology in the natural conditions of plant growth.

A lengthy chapter is devoted to the principles of plant ecology. Plant growth is conditioned by climatic, edaphic, and biotic factors. The various aspects of these factors are considered in sufficient detail, the rôle of soil constituents in determining the distribution of plant communities being discussed at great length. This is not surprising since the present-day tendency is largely directed towards correlating plant growth to several soil factors such as physical and chemical properties, soil water, soil air and organic matter of the soil. The biotic factors manifest themselves through cultivation of the soil, grazing of the cattle and introduction of fire. The last of these is a serious factor because the intensity and frequency of fires largely determine the plant succession, weeds usually spreading after such fires. This is common in the South Indian Plateau.

The methods of practical study are described for the student of vegetation. Following a preliminary reconnoitring survey, a detailed analysis of the plant communities with reference to the climatic and edaphic factors should be made.

Variations characteristic of plant succession deserve considerable attention. The employment of photographs is a necessary adjunct to such a study. Details are given for practical investigation based on the principles presented earlier.

The vegetation of India is so wide and varied that a systematic ecological study of the several important species distributed over a large area and under a diversity of climatic and habitat factors, is bound to give valuable information for the ecologist.

V. I.

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WORLD ECONOMIC SURVEY, 1932-33. (League of Nations, Geneva, 1933.)

There is the well-known dictum of Alfred Marshall that statistics are the straw out of which economists make bricks, and in economics the great difficulty has been all along to get accurate and unambiguous statistics and interpret them without a bias. Not the least of the several kinds of bias that hamper an economist is the national bias. It is common-place to say that economic problems are assuming a world aspect, and consequently need a world outlook, as opposed to a National outlook. Therefore, whatever else the League of Nations may or may not have done, it is a great service to the progress of mankind that an Economic Intelligent Service is an integral part of the activities of the League of Nations. It is an important centre of scientific investigation of economic problems; not only are valuable data collected and issued in the form of monthly bulletins, year-books, and reviews, but handy summaries are also made available for the benefit of the lay-reader. The volume under review is one such.

The purpose of the volume is two-fold: it does not attempt to diagnose causes or weigh political and economic influences, but merely records and interprets economic developments. Another and an important aim is "to view the whole world, rather than special areas, as the theatre of the developments to be described". Emphasis is laid upon "the international aspects of national economic developments and illustrations are drawn from one country or another merely as they prove accessible or convenient." It is neither possible nor necessary to summarise the chapters, constituting as they themselves do summaries of the more elaborate reports. It is sufficient to state that they "record the damping

down of the economic activity in almost every direction", and the even more "serious disorganisation and partial destruction of the delicate machinery of international economic and financial co-operation". The several chapters describe in succession:

1. The Depression of Prices, which continued to include the marked discrepancy between agricultural prices and those of manufactured goods;
2. Diminished Production, with the notable exception of foodstuffs, which showed some increase;
3. A sharp fall in national income, which varied between 20% to 53% from country to country as between 1929-32;
4. Diminished World Trade to about a third of its size in 1929;
5. Fall in Wages and Profits, and Increasing Unemployment;
6. Embarrassment of public finance on account of the inelasticity of expenditure side by side with rapidly diminishing public income.

The Survey is thus mainly a description of "the Contraction of Prices, Production, Wages, Profits, Government Revenues, International Trade and Banking Resources". It records "progressive shrinkage of economic activity in practically every direction". But the concluding sections deal with the World Economic Conference, from which so much was expected, but which proved to be abortive. There is also a brief description of the gigantic American experiment, which, though incomplete, has already furnished the world of students, a remarkable field for observation of laboratory methods. At the same time so diverse are the factors in the economic field that the Survey has to observe that "it is not yet clear how far the improvements and recessions of Industry in the first weeks of the new plan's operations are due to that plan or the result of prior causes. Nor can it be expected that the forces liberated by the plan have yet produced their final or even their most important effects." Both the Economic Conference and the American Plan were preceded by rising prices, increased production and diminished unemployment. As subsequent observations show, these signs of the improved economic health of the world have continued, in spite of the failure of the former, and possibly because of the influence of the latter. It is to be hoped that the concluding sentence of the Survey records a

real state of affairs: "It is probable, however, that apart from speculative advances, there was a more solid core of recovery based upon a definite upward swing of the trade cycle."

N. S. SUBBA RAO.

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MAKERS OF ASTRONOMY. By Hector Macpherson. 1933. Crown 8 vo. pp. 244, with 18 Illustrations. (Oxford University Press.) Price 7s. 6d.

This book is based on the lectures delivered by the author at the Royal Technical College, Glasgow. Besides giving the lives of prominent astronomers, it gives a popular exposition of modern developments in astronomy not always available to the general reader except in advanced text-books and original papers. The reader is enabled to appreciate the steady and silent work of the votaries of science who have devoted their lives to astronomy in spite of deterring circumstances. Beginning from Copernicus who boldly gave a new orientation to astronomy by dislodging the Ptolemaic system, the book narrates subsequent developments in observational and theoretical astronomy, and concludes with an account of the more important contributions of present-day astronomers. "Themselves creatures of a day, chained to the surface of a dwarf planet moving round a dwarf star which is one of millions in a galaxy likewise one of millions," these astronomers have bid us behold "the height, the depth, the gloom, the glory" of the Infinite. The deep debt of gratitude of the readers to which Hector Macpherson is entitled is in no small measure due to his excellent exposition of the subject and his personal acquaintance with many of the more modern astronomers.

The publishers must be congratulated on the get-up of the book. It must be mentioned that books, such as the one under review, intended to be of a popular character will serve their object better if priced more moderately. The book deserves a place in public and private libraries.

L. S.

HYDRAULICS. By Horace W. King. Pp. 296. (Chapman & Hall, Ltd., London.) Price 16s. 6d.

The authors have succeeded in presenting the subject in a simple, lucid and highly interesting manner employing only elementary mathematics for the treatment. The book is readable both by University students and practising Engineers.

It covers the syllabus of a University Course and is very suitable, particularly as a text-book for Civil Engineering students working for an Engineering Degree. At the end of every chapter there are many exercises which add to the usefulness of the book, but their value would have been greatly enhanced, if a larger number of representative exercises had been worked out and included in the body of the book.

The chapter on weirs and dams covers a wide field and the discussion of a number of empirical formulæ with extracts from weir experiments, as well as of the coefficients and formulæ arrived at by various experimenters greatly add to the value of the book. Principles of fluid flow are clearly explained and the method of evaluating coefficients of friction in pipes for all fluids is certainly a valuable addition.

Flow in channels is exhaustively treated and the comparison of the Kutter's and the Manning's formulæ showing the greater simplicity and reliability of the latter as compared to the former especially for flat slopes is instructive. Non-uniform flow in channels and flow under unusual circumstances such as accelerated flow, Hydraulic jumps, translatory waves, etc., are dealt with in a simple and interesting manner.

The chapter on Hydro-dynamics is a welcome addition to the book, but a chapter or two on hydraulic machinery would perhaps make it complete in every respect.

The treatment of the subject is exceedingly good on the whole, for which the authors deserve warm praise.

V. G.

